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03 editorial

TONY SARNO

apc

The future of the PC

We've used a few pages in this issue to try and put to rest one of the myths that's arisen in the last couple of years since the rise of tablets – that the PC is doomed. Seriously, there are analysts who believe that one day we'll do everything on tablets. Actually, you could argue that even Microsoft thinks that, given its desperation to drag Windows 8 away from the desktop and make it an OS for touchscreen devices.

There's no question the PC is definitely overpowered for most of the less-than-taxing things that average consumers do, such as checking emails, surfing the web, listening to music and watching movies. I get that, but at the same time, the PC is where the complex stuff happens. When it comes to being the place where serious work is done or stuff is created, it has no peer. This is why it won't go away. It will sell in fewer numbers, but it will still retain its role as the king computing device in any computing environment.

What puzzles me, though, is the way that PC makers have utterly failed to sell the PC in recent times. I guess that's because they've never really had to; the PC has had personal computing to itself until the arrival of the tablet, so there's no culture or concept of making a PC seem cool. Rather than springing into action, the PC makers (apart from trying to diversify with all-in-ones) have looked like a bunch of roos frozen in the headlights of the oncoming tablet semi-trailer.

Apple is the only company that's always managed to create cachet for its desktops, which means it *can* be done. In our 'Future of the PC' poll in our March issue (see page 8), we asked *APC* readers to give PC makers and marketers some clues as to how they should market the machines. We asked them to spell out for the marketers why anyone would want a PC and in particular, list the things you can do on a PC that you can't on a tablet.

The response to the poll was overwhelming, with hundreds of readers pointing to the key advantages of PCs and making it obvious why the PC will retain a critical role in the wider digital landscape. We've run some of the responses in our 'Future of the PC poll results' story on page 12.

APC's readers went further than just highlighting where the PC rocks. To help the PC marketers, they also came up with slogans for promoting the PC's unique features – slogans that PC vendors might wish to include in their advertising. We even got suggestions for TV commercial scripts!

Lastly, readers came up with ideas for PC manufacturers on how to improve PCs and incorporate some of the features that have proved so popular in tablets.

One of the most pleasing aspects of the poll was that many of the respondents were in their teens or early 20s. Most pointed out that they were also heavy users of tablets and smartphones, although they couldn't envision how they would do without a powerful PC to run intensive software, manage content creation or just have a great time running hardcore PC games.

Hopefully PC makers will get the hint and start making the PC cool again!

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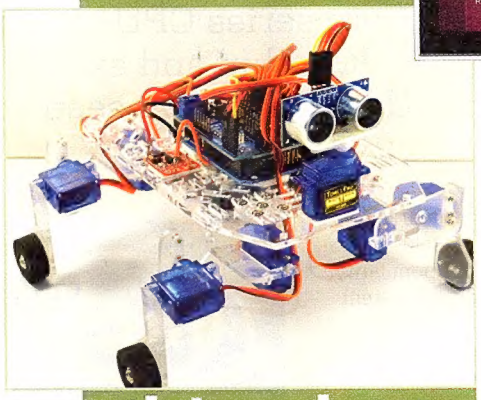

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FEATURE

INTEL LAUNCHES HASWELL

Intel's fourth-generation Core series CPUs have arrived. Darren Yates bench tests the new Core i7-4770K chip and explains why Haswell is the most important CPU launch we've seen in the last 10 years.

It's fair to say the desktop PC is under siege – market analysts are reporting 20% year-on-year PC sales freefalls as smartphones and tablets surge in popularity. Other analysts openly blame Windows 8 for the current malaise. If you're the dominant computer chip maker in that sort of environment, it makes for a treacherous place to try and launch a new x86-architecture CPU series. But after what we've seen this month, Intel looks to have the tools to help stage a PC comeback with the new fourth-generation Core series of processors, codenamed Haswell.

WANTING IT ALL

In years gone by, it seemed like all you had to do to succeed as a processor manufacturer was produce fast chips. Power consumption? Well, as long as nothing melted, no-one was all that concerned. But over the last few years, something of a perfect storm has changed all that – the rise of low-power ARM processors has combined with the smartphone/tablet revolution and rising electricity prices to have everyone demanding lower power consumption from their computing devices. It's no longer performance versus power consumption – you have to deliver both. It's no exaggeration to say this all makes Haswell the most important CPU launch since the release of the Intel Pentium-M processor back in 2003.

We've tested the new top-drawer Core i7-4770K processor this month and although it's only a desktop chip, we've seen enough to think that not only is the desktop PC set for some good times, but Haswell could well be a game-changer for ultrabooks and tablets as well.

POWER CONSUMPTION

Our i7-4770K processor came from Intel accompanied by what is likely to be one of the last Intel-made desktop boards, the DZ87KLT-75K. Featuring the new Z87 chipset, the board is similar to many Z77 options, except for a few extras. All SATA ports are now SATA 6Gbps, so there's no need to worry about sticking your SSDs on an old SATA 3Gbps port. The integration of voltage regulators onto the silicon creates a cleaner board, particularly around the CPU, so it's easier to install heatsink/fan combos.

There's also the new CPU socket, the LGA1150. Intel didn't supply us with a cooling device for the i7-4770K, but the good news is that despite the socket change, previous-generation LGA1155 coolers still fit – the four anchor holes around the CPU socket haven't changed.

With Intel pushing Haswell's power consumption credentials as a major selling point, we were keen to test out just what it had engineered in this new chip. So throwing in a 120GB Kingston HyperX 3K SSD, 4GB of RAM plus the Windows 8 operating system, we fired up the board on a Thermaltake 850W PSU connected to our Labs PowerMate AC power meter. We chose a stock Intel Ivy Bridge cooler on the CPU.

Using just the integrated HD Graphics 4600 engine to power our 1080p monitor, we booted up the board and allowed it to settle, idling on the Windows 8 desktop. The power consumption? Just 28.9W. For a desktop system, that's an astonishingly good result.

To give you a comparison, we cranked up an ASUS P8Z77-V Deluxe board with the now previous-generation Ivy Bridge Core i7-3770K chip and the same components elsewhere. On this same test, the i7-3770K build hit 46.2W. Haswell has lowered that figure by more than a third.

If you're a serious gamer or use your PC as an always-on home server, that sort of power usage drop will be music to your hip pocket. However, more than that, if Intel can get an i7-4770K CPU idling at under 30W, we're keen to see what it can do with truly portable chips like the new CULV parts. Could we be set to see 10-hour battery life on a Windows laptop or tablet for the first time? If so, it'll be a game-changer.

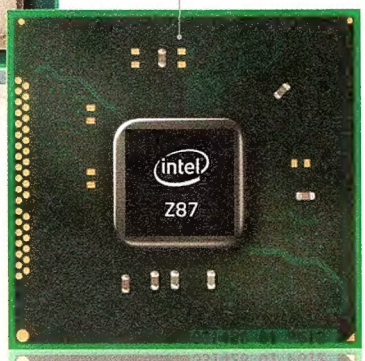
INTEGRATED GAMING

The other major feature Intel has been crowing about is its improved integrated graphics engine. As we reported last month, there are at least two new graphics options: the mainstream HD 4600 engine and the top-flight HD 5200. The Core i7-4770K features the HD 4600 engine. Given that buyers of this chip are almost certain to throw in a discrete graphics card, it's not entirely surprising Intel didn't use the HD 5200 engine here. It would've increased the thermal design power (TDP) rating for little return.

Still, we lined up the i7-4770K against the last-generation i7-3770K with its HD 4000 integrated graphics engine to see just how far Intel has come and whether the hype the chip giant is trying to generate is warranted. We punched both builds through a number of recent games

The Core i7-4770K is Intel's new top-drawer desktop chip.

The Z87 chipset is likely to be a must-have for serious overclocking.



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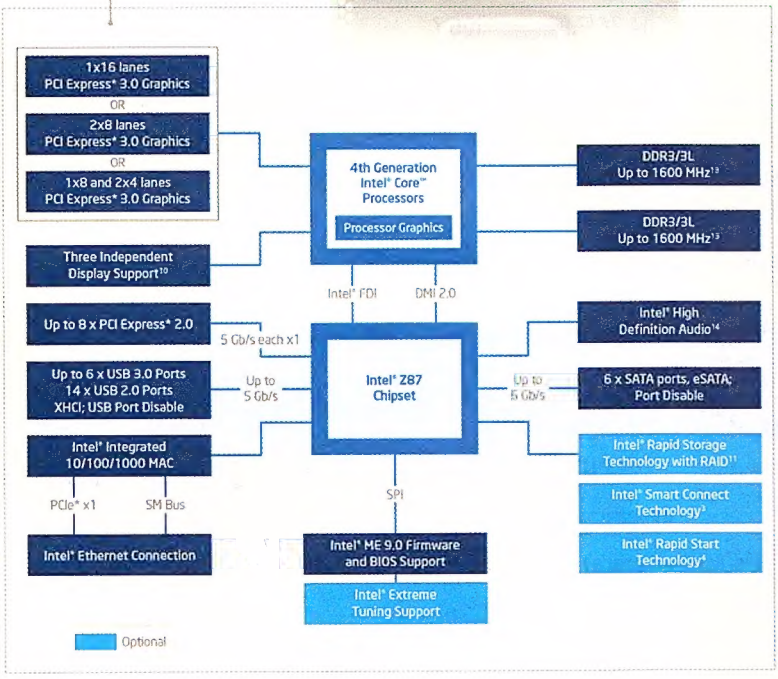
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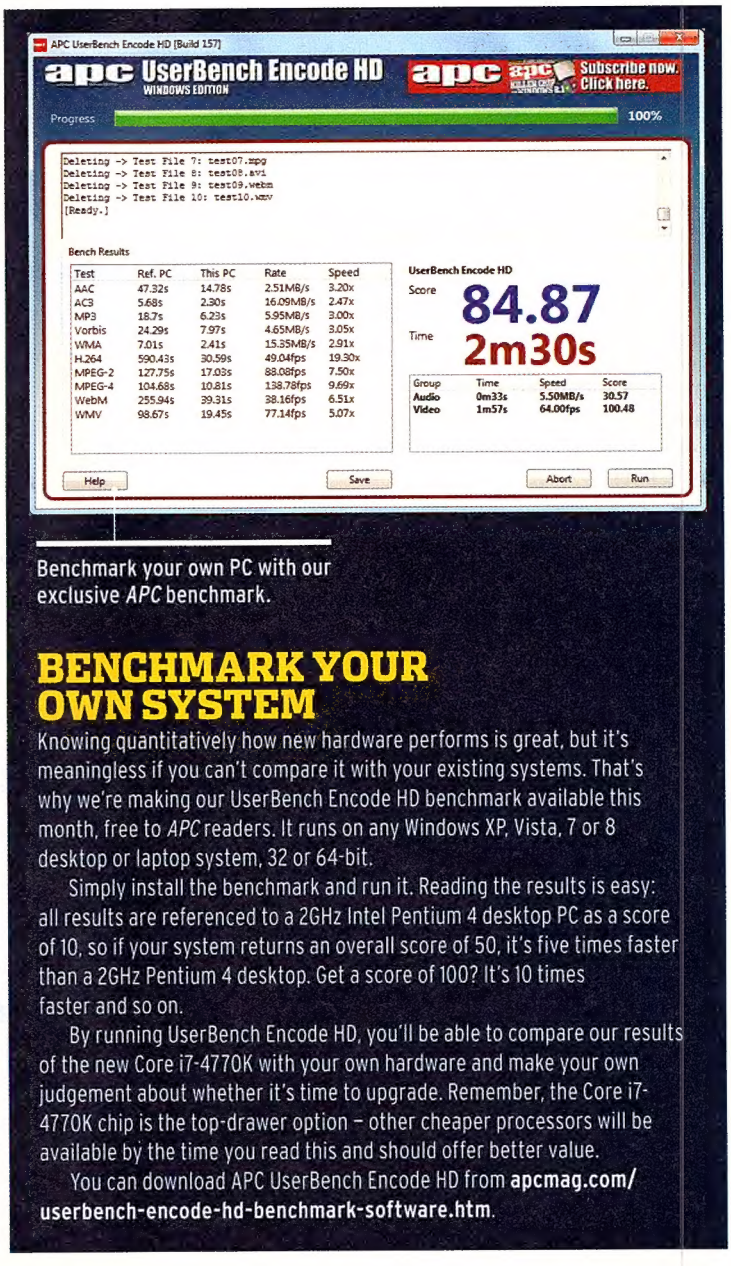
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Benchmark your own PC with our exclusive *APC* benchmark.

BENCHMARK YOUR OWN SYSTEM

Knowing quantitatively how new hardware performs is great, but it's meaningless if you can't compare it with your existing systems. That's why we're making our UserBench Encode HD benchmark available this month, free to *APC* readers. It runs on any Windows XP, Vista, 7 or 8 desktop or laptop system, 32 or 64-bit.

Simply install the benchmark and run it. Reading the results is easy: all results are referenced to a 2GHz Intel Pentium 4 desktop PC as a score of 10, so if your system returns an overall score of 50, it's five times faster than a 2GHz Pentium 4 desktop. Get a score of 100? It's 10 times faster and so on.

By running UserBench Encode HD, you'll be able to compare our results of the new Core i7-4770K with your own hardware and make your own judgement about whether it's time to upgrade. Remember, the Core i7-4770K chip is the top-drawer option – other cheaper processors will be available by the time you read this and should offer better value.

You can download APC UserBench Encode HD from **apcmag.com/userbench-encode-hd-benchmark-software.htm**.

including *Tomb Raider*, *BioShock Infinite* and *DiRT Showdown*, all at 1080p (1,920 x 1,080-pixel) resolution with default settings.

The results? Intel still has some way to go. Sure, gaming isn't all about frame rate, but when you're still this side of 60 frames per second (fps), it matters more than anything else. At 1080p, we couldn't get the HD 4600 engine to reach an average of 30fps on any of these games. The best we saw was a tick over 25fps on *DiRT Showdown*. We then decided to drop the resolution down to 1,366 x 768 pixels and ran *Tomb Raider* and *DiRT Showdown* again. This time, we hit 34.9 and 42.98fps average, respectively. *DiRT Showdown*'s 33.79fps minimum shows that the HD 4600 is a playable gaming option, but realistically, only at this 1,366 x 768-pixel resolution.

What's more interesting is the comparison between the i7-4770K and i7-3770K when it comes to integrated graphics. Here, Haswell isn't far short of twice the average frame rate of its Ivy Bridge predecessor. If you look at the 3DMark 2013 test results, they're similarly proportioned.

The bottom line is that while Intel has made some definite strides forward in gaming performance, its integrated graphics aren't going to trouble a game's Vsync lock at 1080p resolution and standard settings for a while yet. Still, we'd still like to see what the HD 5200 engine can do before we lock those thoughts in concrete.

INTEGRATED POWER CONSUMPTION

While its integrated gaming prowess may not shine as bright as the hype suggests, what impressed us was the fact that Haswell went close to doubling average frame rates and did so, for the most part, with a lower peak power consumption than Ivy Bridge. Remember that Ivy Bridge and Haswell use the same 22-nanometre production process, so the extra speed and lower power draw isn't just from a die shrink.

If you're not interested in gaming, the HD 4600 option will certainly lower your power bills, aside from the other goodies it includes such as improved multimedia transcoding performance.

DISCRETE GAMING

That said, gaming on a Core i7-4770K CPU with integrated graphics is like driving a Ferrari in first gear. So to allow the chip to stretch its legs, we

loaded up this build with the new GeForce GTX 770 GPU in the form of MSI's Twin Frozr card. We did the same with our i7-3770K build to get a handle on any inter-system performance changes. As usual, we had our Labs PowerMate AC power meter connected to it to check its power consumption.

As you'd expect, the performance results were impressive, given that these are latest-generation parts. The fact that the GTX 770 can top 200fps average on *Tomb Raider* at 1080p resolution with Vsync off – compared with the HD 4600's 19.6fps – shows how far integrated gaming still has to go. For the most part, the GTX 770 delivered near on 10 times the average frame rate for very roughly three times the power consumption. Sure, a game's Vsync lock means you see nothing beyond 60fps and might suggest the extra speed is a waste, but having that performance in reserve is what makes a card still usable in two or three years' time.

Comparing the two builds, for the most part the Core i7-4770K once again showed higher frame rates. In the case of *Tomb Raider*, we ran our 1080p test with Vsync switched on and off – off to get raw performance and on to see how power consumption is affected. With Vsync on, Haswell delivered almost a 25W saving. In all cases, though, the Haswell build saw reduced power consumption and higher frame rates. If you own an i7-3770K system, the gains aren't enough to make us think about an upgrade today, but if you have a second-generation or older Core system, you might want to start thinking about your next move.

If you're a fan of 3DMark, you'll see these discrete card results tell a familiar story compared with integrated graphics, again showing close to 10 times the performance levels on Fire Strike and three times on the easier Cloud Gate and Ice Storm tests.

POWER CONSUMPTION

Nvidia's new GeForce GTX 770 design features the same Kepler GK104 GPU as the GTX 670, albeit with higher clock speed, more RAM and more shader units. Combined with the i7-4770K CPU, we didn't see power consumption pass 280W peak on any test at 1080p resolution. We normally use the rule of thumb that your PSU should have around 50-70% headroom in overall output power compared with your system's power draw, so unless you're planning to overclock, our results suggest you shouldn't need anything more than a decent 500W PSU to power this kind of rig.

PROCESSOR PERFORMANCE

As for actual CPU performance, we ran PCMark 7 along with our own APC UserBench Encode HD benchmark to test more general functions. Those of you familiar with *PC User* magazine may recognise this UserBench benchmark developed a couple of years ago. Specifically, it's aimed at audio and video transcoding performance using the open-source FFmpeg tool, which powers many of the freeware transcoders you'll find on the web.

PCMark 7 is an all-rounder benchmark and it showed greater performance difference between the i7-4770K and i7-3770K systems when using integrated graphics compared with running a GTX 770 card. Using the GTX 770, the PCMark 7 performance difference amounted to 8.6%. When using integrated graphics instead, the difference blew out to 18.7% in Haswell's favour. Our Encode HD tests running on integrated graphics-based builds returned an 11.5% gain for Haswell. Having bench tested CPUs for the last 18 years, 10-12% is generally the long-term average gain we've seen from a new-generation Intel desktop family – it's not spectacular, but good nonetheless.

OVERALL RESULTS

In our feature last month, we talked about how important low power consumption would be to the PC in the future. Having Haswell deliver low consumption is critical to seeing it appear not just in tablets and ultrabooks, but also in compact PCs and all-in-ones. The lower the power draw, the more processing

HASWELL vs. IVY BRIDGE – INTEGRATED GAMING TESTS

CPU	Intel Core i7-4770K		Intel Core i7-3770K	
Graphics	Intel HD Graphics 4600		Intel HD Graphics 4000	
	Average/ minimum fps	Peak power (W)	Average/ minimum fps	Peak power (W)
Tomb Raider (1,920 x 1,080 pixels)	19.6/15.5	96.8	11.1/8.1	104.8
Bioshock Infinite (1,920 x 1,080 pixels)	14.26/7.9	106.7	8.12/1.89	101
DiRT Showdown (1,920 x 1,080 pixels)	25.06/20.51	68.3	14.37/12.5	83.5
DiRT Showdown (1,366 x 768 pixels)	42.98/33.79	79.7	22.44/17.92	81.3

NOTE: higher fps scores are better; lower power scores are better.

HASWELL vs. IVY BRIDGE – DESKTOP PERFORMANCE TESTS USING INTEGRATED GRAPHICS

CPU	Intel Core i7-4770K	Intel Core i7-3770K
Graphics	Intel HD Graphics 4600	Intel HD Graphics 4000
3DMark 2013 – Fire Strike (score)	836	455
3DMark 2013 – Fire Strike (graphics/physics)	904/10,267	477/8,024
3DMark 2013 – Cloud Gate (score)	7,121	4,548
3DMark 2013 – Cloud Gate (graphics/physics)	7,031/7,457	4,230/6,174
3DMark 2013 – Ice Storm (score)	54,058	33,553
3DMark 2013 – Ice Storm (graphics/physics)	55,479/49,612	31,624/42,662
PCMark 7 v1.4	6,494	5,467
UserBench Encode HD (score/min:sec)	133.29/1:36	119.50/1:47
Power consumption – Windows desktop (W)	28.9	46.2

NOTE: higher scores are better, except for Encode HD's time-based test.

power Intel can design into these space-confined devices.

Sure, one chip tested doesn't make a revolution. But given the gains we've seen in power consumption, there's enough here to suggest Intel should be able to do similarly with its mobile parts. And given the mobile computing boom, it could give Android and Apple plenty to think about.

Unfortunately, Microsoft's Surface Pro tablet just released into Australia runs an Ivy Bridge Core i5-3317U chip, for what Microsoft says is around five hours of battery life. If Haswell can bump that up to eight or 10 hours, you'd be looking at a device that lasts as long as an iPad, although with a boatload more performance. And these days, that's the real trick to success: battery life *and* performance.

THE USB 3.0 BUG

As we reported last month, the Lynx Point/Series-8 chipset has a minor problem with its USB 3.0 controller, where some flash drives can disappear when the system is brought back from a low-level sleep state. Intel issued a C2-stepping chipset replacement, although motherboard manufacturers won't see these new chipsets until the end of July. That means initial launch boards will have this bug. Intel says there's no data loss or corruption, so you can choose to buy now if you wish. However, if it were our money, we'd wait until August or September for C2-stepping boards to arrive.

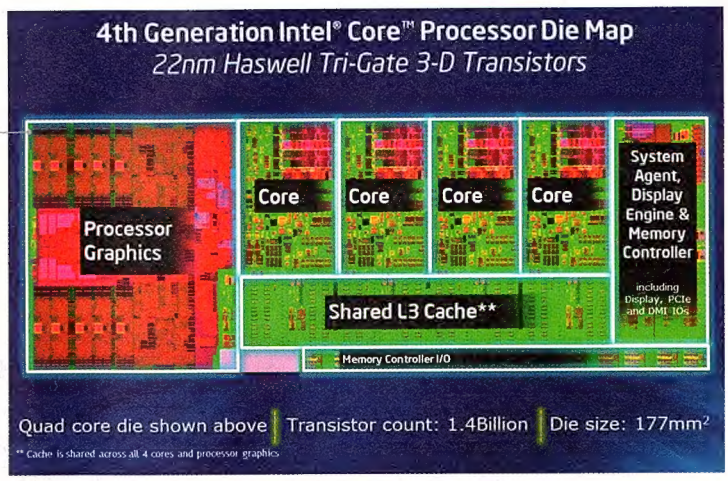
Unfortunately, the bug affects all Haswell-based products: laptops, PCs and tablets. This is unfortunate because otherwise, Haswell is an impressive design. The integrated HD 4600 graphics engine may still be ho-hum from a gaming perspective, but Haswell's general performance combined with significantly lower power consumption makes it the most important CPU launch in the last decade.

HOW OFTEN SHOULD YOU UPGRADE?

If you're a PC enthusiast, this is the perennial question: how often should you change kit? Intel works on a biennial 'tick-tock' development cycle – the 'tick' introduces a new smaller-scale production process while the 'tock', which is what Haswell falls under, refines that process and adds in better features. (Interestingly, Intel chose Haswell to introduce a new CPU socket, the LGA1150.)

Generally speaking, you should get two years from a system platform – after that time, you'll find CPU upgrades become problematic. Where possible, we suggest trying to synchronise your upgrades with Intel's 'tock' development cycle, as it gives the chip giant an extra cycle to get the smaller production scale right, as well as netting you better features. In Haswell's case, that's lower power consumption and improved integrated graphics speed.

Here's a map of the new Haswell quad-core processor – don't get lost!



HASWELL vs. IVY BRIDGE – DISCRETE GAMING TESTS

CPU	Intel Core i7-4770K		Intel Core i7-3770K	
Graphics	Nvidia GeForce GTX 770		Nvidia GeForce GTX 770	
	Average/ minimum fps	Peak power (W)	Average/ minimum fps	Peak power (W)
Tomb Raider (1,920 x 1,080 pixels) – Vsync off	203.1/162.0	279	201.0/144.0	298.1
Tomb Raider (1,920 x 1,080 pixels) – Vsync on	59.9/58.0	150.7	59.9/58.0	175.2
BioShock Infinite (1,920 x 1,080 pixels)	153.52/18.28	260.6	148.14/21.02	274.1
DiRT Showdown (1,920 x 1,080 pixels)	145.8/107.33	279.1	123.55/92.88	286.5

NOTE: higher fps scores are better; lower power scores are better.

HASWELL vs. IVY BRIDGE – DESKTOP PERFORMANCE TESTS USING DISCRETE GRAPHICS

CPU	Intel Core i7-4770K	Intel Core i7-3770K
Graphics	Nvidia GeForce GTX 770	Nvidia GeForce GTX 770
3DMark 2013 – Fire Strike (score)	7,077	7,187
3DMark 2013 – Fire Strike (graphics/physics)	7,928/10,922	8,203/9,698
3DMark 2013 – Cloud Gate (score)	22,837	21,441
3DMark 2013 – Cloud Gate (graphics/physics)	50,000/7,871	53,325/6,933
3DMark 2013 – Ice Storm (score)	158,938	144,104
3DMark 2013 – Ice Storm (graphics/physics)	353,849/54,284	318,098/49,445
PCMark 7 v1.4	6,663	6,134
Power consumption – Windows desktop (W)	48.9	63.9

NOTE: higher scores are better

10 gadgets

GEAR WE WANT

Recon Jet

Whether anybody actually wants them or not, wearable gadgets are set to be 2013's biggest tech trend. But if you want to look less geek and more cyberpunk chic, these Google Glass competitors combine a heads-up display (which appears at the bottom-right of your view) with a pair of sporty polarised sunglasses. There's a dual-core CPU running the show and a dazzling list of sensors (thermometer, magnetometer and accelerometer) along with the usual GPS, Wi-Fi, Bluetooth and HD cam and display. There's still some doubt over apps – the glasses run a custom OS, so apps will need to be specifically designed for them.

ONLINE jet.reconinstruments.com

Aeryon Labs SkyRanger

This weather-sealed drone packs twin cameras (one 1080p and one infra-red), can withstand temperatures of -30°C to 50°C and 65km winds, and has a 50-minute flight time. Oh, and it'll keep flying beyond line of sight for 3km. The SkyRanger is primarily intended for military and government use and there's no word on price yet (you'll have to request a personalised quote). You know it'll totally be worth it to terrorise that neighbourhood cat that keeps peeing in your herb garden.

ONLINE www.skyranger.com

Finis Neptune

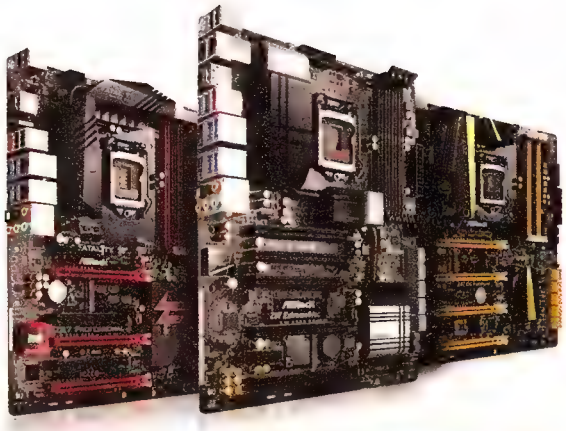
The flexibility and portability of digital music means we can listen to it pretty much everywhere these days. Now you can add down the pool or beach to that list. Sound doesn't usually transmit especially well underwater, but these waterproof bone-conduction headphones are actually designed to rest a little in front of your ears. They promise to provide 'crystal-clear audio' by blasting sound directly through your cheekbones and into your inner ear. Sounds blissfully painful to us.

ONLINE www.finisinc.com

A-STYLE

Your Lifestyle

- Supports 4th Gen Intel® Core Processor
- Waterproof by Conformal Coating
- Home Cloud
- WiFi 802.11ac
- Purity Sound™
- HDMI-In



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Capitol Computer	02 9281 8890	capitolcomputer.com.au
ilBuy	02 9599 0698	ibuy.com.au
IJK	02 9745 0877	ijk.com.au
Megaware Computer	02 9608 1593	megaware.com.au
MSY	02 9755 0668	msy.com.au
mWave	1300 727 446	mwave.com.au
Nexcom	02 4721 3457	dcomponene.com.au
North Shore Computers	02 9939 1546	nscom.com.au
PC Lan	02 9649 3288	pclan.com.au
PC Meal	02 9746 7886	pcmeal.com.au
D & D COMPUTER TECH	02 9742 3986	ddcomputer.com.au
DIY COMPUTERS	02 9897 9993	diycomputers.com.au
MAIG PTY LTD	02 9648 2261	maig.com.au
J&W	02 8090 3332	jw.com.au

QLD

Computer Alliance Pty Ltd	07 3420 3200	computeralliance.com.au
Game Dude Pty Ltd	07 3387 1500	gamedude.com.au
MSY	07 3290 1738	msy.com.au
Umart Online	07 3369 3928	umart.com.au
AUSCOMP COMPUTERS	07 3722 5100	auscompcomputers.com

VIC

Computers & Parts Land	03 8542 8688	cpl.net.au
MSY Technology	03 9560 2288	msy.com.au
PC Case Gear	03 9551 0889	pccasegear.com
Centre Com Sunshine PTY	03 8311 7600	centrecom.com.au
Scorpion Tech. Computers	03 8561 3200	scorptec.com.au

NT

PC Solutions 4 U	08 89412119	pcsolutions4u.com.au

TAS

Principal Computers	03 6235 5000	tasmanianpc.com.au

WA

Austin Computer	08 9201 2788	austin.net.au
MSY	08 9344 1002	msy.com.au
Netway Computers	08 9332 0888	netwaycomputers.com
Netplus Micro Computers	08 9242 7288	netplus.com.au
PC West	08 6396 4813	pcwest.com.au
PLE Computers	08 9309 4771	ple.com.au
Worldwide Net Solutions	08 9375 9666	netsolution.com.au
ARROW COMPUTERS	08 9258 7733	arrowcomputers.com.au

SA

Hypernet Computer Distribution	08 8340 2021	hypernetdist.com.au
MATS Systems	08 8186 2110	mats-systems.com.au
MSY Technology (SA) Pty Ltd	08 8212 1656	msy.com.au
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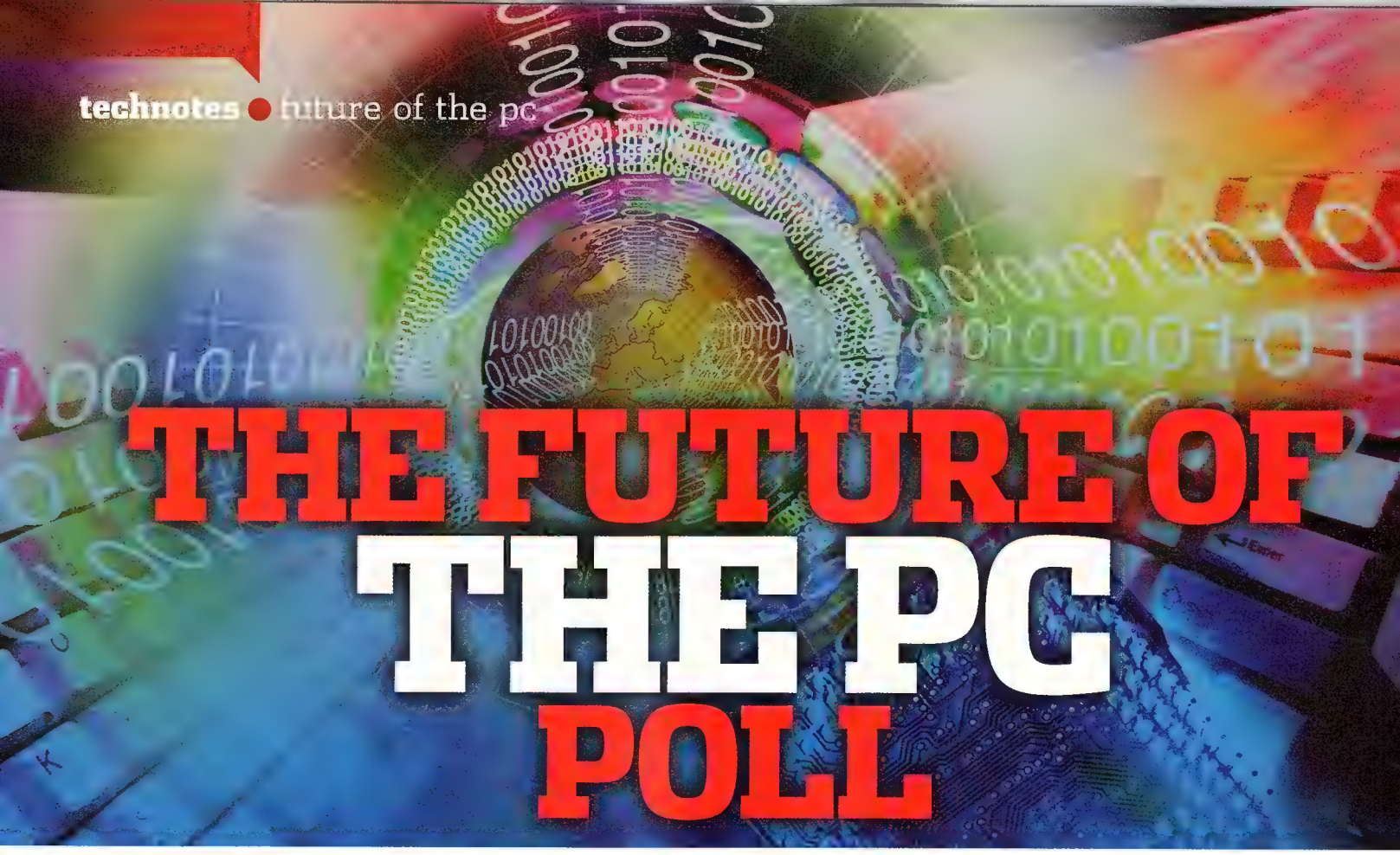


THE FUTURE OF THE PC POLL

In our 'Future of the PC' poll, *APC* readers tell us why the PC isn't going to be replaced by mobile devices anytime soon, and also offer advice to PC makers on how to sell the machines.

What's a PC? It's not just a personal computer, because tablets or smartphones are also personal computers. A PC is the personal computer that lets you do the serious stuff, from playing intensive games at home, to creating designs or running spreadsheets which allow you to earn an income. Unlike a tablet, a PC is built around an open architecture and is configurable to meet your needs. While a laptop or an all-in-one PC are both fundamentally PCs, they're less configurable, so the focus of our poll was on the traditional PC.

The PC's place in the digital landscape, alongside tablets and smartphones, is so clear, so irreplaceable and so critical that it irks our readers (and us) when industry pundits – and impressionable tech bloggers – constantly deliver the last rites. Even schools, which should know better, are swapping PCs/laptops or Macs/MacBooks for tablets, continuing a trend that some readers have called the 'dumbing down of tech'.

Reader Peter Croft says: "I see tablets and the like as just another example of the constant dumbing down of tech. All the kids want the easy path. Sorry kiddies, some things require work and study and skill."

"I SEE TABLETS AND THE LIKE AS JUST ANOTHER EXAMPLE OF THE CONSTANT DUMBING DOWN OF TECH. ALL THE KIDS WANT THE EASY PATH. SORRY KIDDIES, SOME THINGS REQUIRE WORK AND STUDY AND SKILL."
Reader Peter Croft

"I REALLY LIKE TECH STUFF, BUT WE DON'T CONSUME A WHOLE LOT OF FLUFFY CONTENT, IT'S MUCH MORE FUN CREATING THINGS AND THE TABLETS I'VE TRIED SUCK PROFOUNDLY AT THIS."
Reader Flymow

Many are puzzled that there's even a tablet/smartphone versus PC debate. "I have mobile devices, smart TVs, smartphones, smart everything, but nothing matches my PC in terms of power, performance and flexibility", says John Gangemi, adding: "The PC is king when it comes to this. Need a bigger monitor? Easy. Need more disk space? No problem. Need more RAM? No worries. Need to do some serious gaming and work? Buy a PC."

Jacob Logan adds: "No device, no matter how compact, portable or interactive, will ever match the desktop PC's dominance in the fields of content creation, programming and gaming." Another reader, going by the handle of Flymow, says: "I really like tech stuff, but we don't consume a whole lot of fluffy content, it's much more fun creating things and the tablets I've tried suck profoundly at this."

David Harpley says: "This beatup re smartphones, etc. reminds me about the 'paperless office' we were promised in the eighties. We're still waiting... Seems the latest fad is always the best and greatest, about to replace all before it. Rarely happens."

Ultimately, says Sebastian Stinton: "You can do anything with a PC. Your limit is your imagination."

ADVICE FOR MARKETERS

Overall, there's disappointment that – with the exception of Apple – computer vendors are failing to sell the PC in the face of the tablets' onslaught and possibly leading to disappointed consumers. In his job, reader Matt Cooper gets to hear what consumers want every day and is convinced the "keyboard and mouse will always be king". He says: "Selling tablets and PCs daily at a local electronic retailer, I see this common question: 'do I buy a PC or a tablet?' and in most cases the customer still wants to burn CDs, type out documents and use USB sticks. The PC will win nine times out of 10."

So the purpose of this poll is to give computer vendors some ideas for marketing the PC. Given the unique characteristics of PCs, it shouldn't be that hard, should it? The key here is not to sell the PC as an either/or option against tablets, but rather as a piece of technology everyone needs regardless.

TOP 20 MARKETING SLOGANS

We asked *APC* readers to suggest some slogans that PC makers can incorporate into their advertising. Here are the top 20 in no particular order.

- PC – just the way you want it
- The PC – when you're serious, come and see us
- Work with a PC. Play with a tablet.
- PC – get things done
- Tool for the job
- More grunt than a runt
- PC's rule while handhelds drool
- True performance. Real choice.
- You can do it on a PC
- Power through the day with a PC
- Flexible, upgradable and repairable.
- Six words per minute is pathetic
- A tablet is something you take when you're sick
- Not available in pink
- Not another boy toy
- When you grow out of toys, use a real machine
- You wouldn't use a tricycle to transport an elephant
- Do all the stuff that the feeble things can't do! And you don't have to smear your screen!
- Computers not toys
- Sometimes the old ways are best. (*Skyfall* line, but still applicable)

TV COMMERCIALS

Seeing that the marketing of PCs has been such a bust, here are some scripts for TV commercials that readers would like to suggest to PC vendors. We've picked three of the best ones. We've edited them a little for brevity and impact.

COMMERCIAL 1

Reader Chris Doolan was prolific, sending in various TV commercial ideas, but here's a good one.

Scene 1: A user holds a tablet on which he's updating Facebook and says: "When I play, I'm on my tablet, but when I work, I'm on my PC".

Scene 2: The camera then cuts to him grinning, sitting in front of a PC with three 27-inch gaming monitors, wearing Corsair headsets and playing a 3D computer game. The point, says Doolan, is that a PC is superior in absolutely every way, from doing work to playing.

COMMERCIAL 2

This one is also from Chris Doolan.

Scene 1: A user is trying to view Google Earth on a phone, struggling to navigate the map and zooming in and out of it.

Scene 2: The user is on a PC with three 27-inch monitors, viewing Google Earth covering all three in all its glory.

Voiceover: "Your phone/tablet is only a keyhole view to the internet; it's your PC that's the window to the world".

COMMERCIAL 3

Andrew Cruickshank suggested this variation of a Jack Daniel's commercial.

Scene: A couple of old guys, or 'geek craftsmen' talking about how they've kept turning over parts in the same quality case for the last five years.

The moral of the story is that while a tablet becomes obsolete after a couple of years, you can get heaps of mileage from a PC.

WHERE A PC BEATS A TABLET OR SMARTPHONE

For the benefit of PC marketers, *APC* readers have highlighted the key areas in which PCs rule. These are the reasons the PC is king and will remain king of your personal computing platforms.

1 HARDCORE GAMING

Nothing shows off the glorious performance of a PC – and the ability to run peripherals to further enhance the experience – than serious PC gaming. "A mobile device will never match the graphics performance of a half-decent PC in a million years, let alone today," says reader Jacob Logan.

Mike Tuppen points to good simulations as being impossible on a tablet: "I like to play realistic racing simulations (ie. *Grand Prix Legends*, *NR2003*, *GTR 2*, *RACE 07*), which aren't available on any mobile device or game console for that matter."

Thirteen-year-old Yosiah de Koeyer speaks for all of us when he says: "You can play *real* games on a PC. Lots of the games for iPod/iPad/Windows Phone, etc. are just like mini-games and are usually finished in a day or two."

Readers also point to the inability of tablets and smartphones to handle 4K graphics anytime soon. "Tablets are fine for slow solo play like *Fruit Ninja* or *Angry Birds*, but that is about it," sums up Sean (surname not provided).

"YOU CAN PLAY *REAL* GAMES ON A PC. LOTS OF THE GAMES FOR IPOD/IPAD/WINDOWS PHONE, ETC. ARE JUST LIKE MINI-GAMES AND ARE USUALLY FINISHED IN A DAY OR TWO."

Reader Yosiah de Koeyer

2 CONTENT CREATION

As much a tablet weakness as a PC advantage is content creation. Trying to do serious content creation on a tablet or smartphone is a recipe for pain and frustration, as several readers found.

Max Perry often edits many hours of AVCHD video files, running the editing program on dual 24-inch high-quality monitors. "Rendering the final video to a single file can run all eight cores of my i7-930 CPU, with 12GB of RAM, at 100% for several hours. Try that on a tablet or notebook," he says. But he's not finished. "Run Adobe Photoshop CS5 on a 24-inch high-quality monitor with the photo enlarged almost until the pixels can be seen to touch up flaws, etc. and then try that on a tablet."

"I PHOTOSHOP OUR PHOTOS EVERY NIGHT ON MY SONY ULTRABOOK WITH TWO SSDS IN RAID 0."

Reader Alistair Campbell

"My wife and I travel a lot," says Alistair Campbell. "I Photoshop our photos (and she has digital dysentery) every night on my Sony ultrabook with two SSDs in RAID 0. Try doing that on a smartphone or tablet in anything like the time it takes me. I will be in bed hours before you and the job will be done better."

Stephen Cooper points out that decent music recording capability – involving the recording of live music and vocals, multitrack mixing and stereo mastering – wouldn't be impossible on a tablet. Still on music, Mike Tuppen says: "I use REAPER for music production and a multitude of free plug-ins (ie. Independence Free). While there are alternatives available on mobile devices, they don't offer as much as what I have now (due to all the plug-ins) and don't have any flexibility."

Peter Croft sums it up: "Serious video editing; serious slideshow creation (mine are Full HD and include HD video); Blu-ray authoring and burning; serious writing, including illustrations; big image editing; vector illustration; CAD; database work; audio workstations; programming, computer-based training; electronics design and simulation; PCB design... Need I go on?"

Harry Truong adds: "And soon PCs will have 4K graphics, something tablets and smartphones won't have for a long time."

3 RUN INTENSIVE SOFTWARE

The most obvious advantage of a PC over a tablet is power. "When something needs grunt, where do you turn?" asks Craig Ashton, adding: "Have you tried running a complex spatial setup on an iPad? Sure, you could probably land a man on the moon with an iPad, but ripping your Blu-rays? You want threads and cores, man." Micheal Clark adds:

"WHEN SOMETHING NEEDS GRUNT, WHERE DO YOU TURN?"
Reader Craig Ashton

"intensive workloads such as 3D modelling, video editing and scientific calculations are still impractical, if not impossible on a mobile device."

But it's not just intensive software. Big screens plus the comfort of using a mouse means spreadsheets are much easier to work with on a PC. "I work with a lot of spreadsheets. Touch input devices cannot compare to the speed and accuracy of a mouse and keyboard", says Matt Cooper.

Even programmers can't imagine doing their work on anything but a PC. "While I can open, edit and sometimes even compile simple code directly on my tablet, it is not suitable, nor capable for serious programming yet," says Mitchell Smith.

Sean adds: "Even with a keyboard attachment to a tablet, I could not imagine trying to view and debug code on a tablet, I don't even enjoy it on a laptop. Multiple screens and not feeling cramped is the only way to go for me."

And of course, most serious business software isn't available for tablets or smartphones. "My wife is a bookkeeper so she uses the PC for QuickBooks, which isn't available on mobile devices," Mike Tuppen says.

4 TRUE MULTITASKING

Having a bunch of programs open and running at the same time is one of the joys of having a PC. Nigel Quayle says a PC allows you to visually multitask. "A PC can have a large area of screen(s) available to display programs or documents alongside each other for visual comparison."

Eddie S puts it well when he says: "I listen to music while reading email via an SSH client, transcoding a home video, keeping an eye on the weather radar and using a webcam at the same time, all run over two screens."

M.A Howley adds: "When building a web site, I often have Photoshop, a word processor and three browsers open simultaneously (each with multiple tabs open). Try that on a tablet!"

5 RUN LARGE/MULTIPLE MONITORS

The ability to run multiple monitors off a single PC means productivity can be sky high. John Hogan says he appreciates the myriad benefits of big and/or multiple screens, which means he can have "research windows, word processors, music, Twitter, etc. running there in front of you". "You can run big displays on a PC," says Michael Clark: "Mobile devices have high resolutions, but still the screen is too small to have multiple applications open."

"TOUCH INPUT DEVICES CANNOT COMPARE TO THE SPEED AND ACCURACY OF A MOUSE AND KEYBOARD."
Reader Matt Cooper

6 VIRTUALISATION

No tablet or phone can run the previous OS within a virtual machine. On a PC it's easy. Eddie S says: "You can run VMs with different OSs from Linux distros to different versions of Windows, all nicely sandboxed from each other."

Reader Col H says: "I just upgraded my PC with the latest hardware, have dual screens and Windows 8 Pro, which has Hyper-V that works really well for me, as I virtualised my previous Windows 7 Ultimate PC with its WinXP virtual machine and it all works as it used to."

7 BIG STORAGE

A PC allows you to add virtually unlimited local storage, says Stephen Cooper. "I have a movie library – there's 1,000 movies on hard disk that can be streamed to TV over Wi-Fi." John R Middleton points out he has expanded his system to store an astonishing 30TB of music and 24TB of images.

8 HOME SERVER/MEDIA CENTRE

You can turn a PC into a serious home media centre. Reader Kawastoney says: "I use the PC as a media centre. I've added four tuners, a capture card and extra hard drives." Jon Gould writes that he can "record four TV channels simultaneously whilst watching TV and maintain all my music, photo, TV and movies in storage measured in terabytes."

"BULK TYPING IS IMPOSSIBLE ON TABLETS. CAN YOU TYPE A *HARRY POTTER* NOVEL ON A TABLET WITHOUT RIPPING YOUR HAIR OUT?
Reader Craig Ashton

9 FULL-SIZE KEYBOARD & MOUSE

On a PC with a full-size keyboard, you can type fast and with high accuracy. It's also possible to attach a keyboard to a tablet or phone. Yosiah de Koeyer says: "Typing for me is very hard on any type of portable device. Nothing can compare to typing on a normal desktop keyboard." Craig Ashton adds: "Bulk typing is impossible on tablets. Can you type a *Harry Potter* novel on a tablet without ripping your hair out? Add to that clicking and dragging with a mouse; try highlighting bulk multiple files on a tablet."

With the exception of Windows 8 tablets and a handful of Androids, you can't attach a mouse to the vast majority of tablets, including the iPad. "The accuracy of a mouse is difficult to emulate on a touchscreen. Many tasks need the raw processing grunt a desktop gives as well as big (or multiple) screens and peripheral connectivity. Some web sites are painful to use with a touchscreen," says another reader, David.

10 BUILD/CUSTOMISE IT

Last but not least, you can build or customise a PC – something that's impossible on the appliance-like tablets and smartphones. PCs offer users the "ability to cost-effectively and/or extensively customise the hardware without having to buy an entire new device," says Mark (surname withheld).

Mike Kramer adds: "The PC gives you the ability to mix and match hardware to suit your work environment to be most productive. Like get a graphics card that has two DisplayPorts and a DVI port to run multiple high-resolution screens, or add multiple hard drives to keep your data storage easily accessible and backed up in RAID 1."

Clay Pettit picks up on another pleasure of building or customising your own PC: "You get a feeling of pride and accomplishment after setting up a new system and it boots the first time." Adrian Monsif agrees, saying that building a PC gives you "nerd bragging rights".

WHAT PC MAKERS NEED TO DO TO IMPROVE PCs

No-one is saying the PC is perfect. Our readers think PC makers should also look at ways to improve PCs and make them more consumer friendly. Young *APC* reader Louis Jennings (a.k.a. El Esgrimidor) was a big contributor to this list.

1 ADD FEATURES FOUND ON TABLETS

Where relevant, PCs should include features that are found in tablets and smartphones, such as touchscreens, GPS services and higher-resolution screens, as well as things such as instant-on. This is particularly the case with ultrabooks, which could easily provide a more consumer-centric, rounded tablet-like experience, but with all the extra power and storage of a real computer.

2 REMOVE TRIALWARE AND BLOATWARE

APC's readers believe PC manufacturers should avoid trialware and bloatware on new PCs or laptops. It's junk, aggravates users and doesn't come with tablets. One reader suggested that adding $100 to the price of a PC wouldn't turn customers away if it meant they didn't have to waste considerable time ripping the crapware off the machine.

LOUIS JENNINGS
(a.k.a. El Esgrimidor)

Readers urge Microsoft to better research what users want out of the Windows OS.

3 MORE CONSISTENT QUALITY & RELIABILITY

Some readers felt that PC makers include too many cheap components in PCs, which in turn make them far less reliable than tablets and smartphones. This was particularly the case with laptops, where touchpads are regularly of questionable quality and screens are of average resolution compared to the super-high-quality ones on some tablets and smartphones. Sound was also considered another poorly-served feature on PCs.

4 BETTER INTEGRATION WITH THE OS

There should be better integration between the Windows operating system and hardware on PCs, with one reader pointing to Apple's celebrated hardware and software integration. He suggested that Microsoft, Intel, AMD, Nvidia and so on give certified manufacturers an API to modify certain parts of the operating system/drivers to provide unique functionality for their PCs or laptops.

5 STRENGTHEN THE PC'S CENTRAL HUB ROLE

PC makers should make the PC take over more functions as a central hub to manage not just peripherals, but the entire home. One reader says: "Microsoft had a whitepaper about integrating the PC with a hot water service as a combined heat and computing power device for the home, which was a nice idea. Good to use the waste heat well."

6 EASY-TO-REMEMBER NAMES

Manufacturers should also provide names for PCs and laptops that are easy to remember, rather than having product families defined by numbers with many sub-models. One of the most frustrating issues faced by laptop buyers is confusion created by the endless variants of the same laptop, which often result from tiny spec differences, and in some cases, from which retailer sells them.

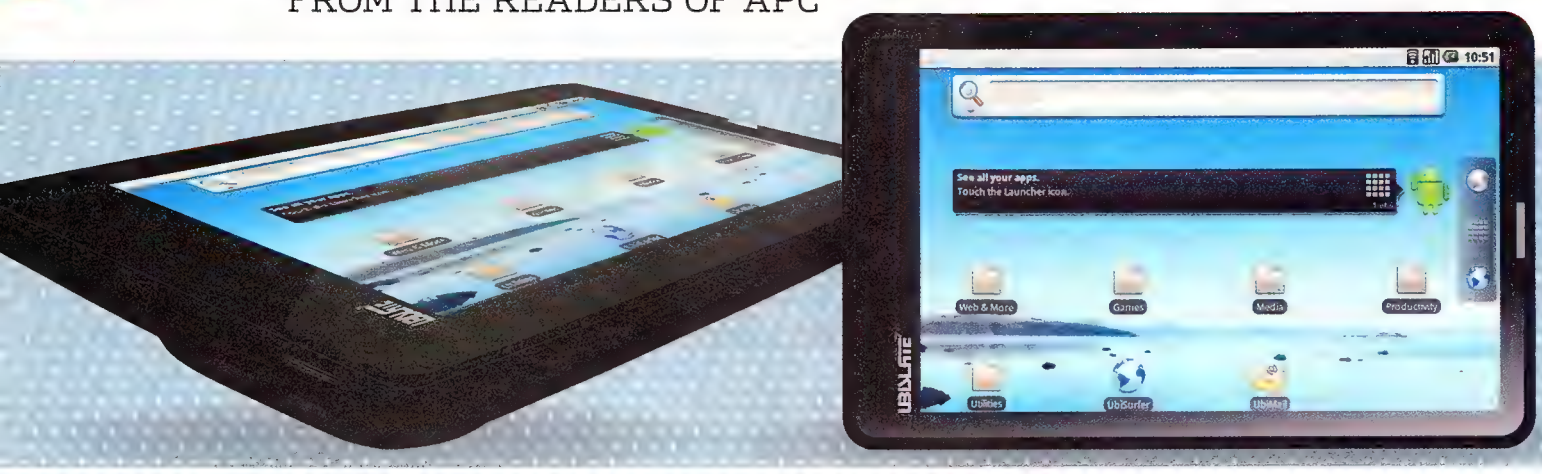
7 FIX WINDOWS 8

Windows 8 hasn't exactly set PC and laptop sales alight and *APC* readers believe Microsoft should better research what users want. However, since the poll, Microsoft has announced the update Windows 8.1, which addresses some of the annoyances that alienated users in Windows 8. In combination with Intel's new Haswell chips, we should see a formidable combination of hardware and OS that should provide PCs and laptops with a real boost.

8 FOCUS ON LAPTOPS

Some readers believe that PC makers should focus on improving laptops rather than worrying about desktop PCs. After all, laptops are basically desktop PCs shrunk to a portable size. Giving up the configurability of a desktop PC is a necessary price to pay to make Windows and Linux PCs more relevant to consumers, they argue.

Whichever way you look at it, the role of the serious computer, with serious processing power, memory and storage, and the ability to multitask and run multiple screens will remain a critical one. The PC ain't going away, no matter how well tablets sell. apc



THE $20 TABLET DREAM

We want to believe, we really do, but is the Indian $20 tablet really a goer?

A few years ago, Suneet Singh Tuli, the founder of Canadian hardware maker Datawind, saw an opportunity to supply Indian students with a $20 7-inch tablet. Yes, you've read right, $20 (quoted in US dollars, which works out to be about the same in Australian dollars).

He got the Indian government to agree to buy the tablet for its actual $35 cost and subsidise it so it would cost students only $20. It seemed like an extraordinary achievement that hardly anyone outside India knew about, until November last year when he released version two of the so-called Aakash tablet.

A $20 tablet seemed like a miracle and this time the world's tech media jumped on board, as they often do with any technology that catches their eye, even without actually testing or even seeing it. "The tablet that could change the world," blared one major tech news site. "How a $20 tablet could blindside PC makers," screamed another. Without seeing the tablet, CNET waxed lyrically, reporting that an Indian gadget show had looked at the tablet and declared it "fairly impressive." The US tech media was in agreement: Suneet was a hero out to show how tablet makers like Apple, Google and others were gouging the public with $500 tablets.

Of course, none bothered to check what had happened with version one of the Aakash tablet. Four million units of this tablet were ordered by the Indian government the year before for a government-sponsored e-learning program in Indian schools. The government would subsidise the cost of each for its students.

But the order never shipped. Apparently, the tablets were beset with problems and roughly a third wouldn't turn on, while many of the rest didn't work properly. When curious users opened up the tablets to try and fix them, they discovered that they were put together very cheaply and electrical tape held many of the components together.

There were also problems on the financial front, with banks who'd put up money for the project wanting to see results. India's *Economic Times* quoted an analyst from Gartner who said there was no way the tablet could be made for $35, saying the screen and microprocessor alone would cost more than that. The analyst estimated the entire cost of the $20 tablet components at more like $125. Then, some of the government's thinking behind the low cost to students came out – the government had planned to cover its subsidy by selling the tablet at a much higher price overseas; in other words, adding yet another shitty tablet to the millions of $50 to $100 shitty tablets pouring out of Shenzhen in China.

So, when Suneet Singh Tuli released version two of the tablet (also known as the Ubislate 7Ci), we should have expected a little bit more scepticism from the world's tech media, but with some minor exceptions, there wasn't. We're not death-riding the second tablet, of course, but if past performance is the best indicator of future performance then we're not holding our breath.

Compared to the first one, version two of the Aakash tablet is much better spec'd, which is an encouraging start. It's almost identical to the first Kindle Fire, with an 800 x 432 capacitive touchscreen, a 1GHz Cortex-A8 ARM processor, 512MB of RAM, 4GB of storage and it runs Android 4.0 (Ice Cream Sandwich). It also has a VGA front-facing camera, a microSD slot and connects via Wi-Fi and even GPRS mobile.

As per the original agreement, the tablet is being sold to the Indian government, which is making it available to students for the originally intended price of $20. A rare review says it's tinny, the colours are off and the battery life is 3 hours. However, for $20 nobody should complain. Here's hoping the problems of the first tablet don't repeat themselves and that Suneet Singh Tuli has pulled off a miracle. APC

ENDUSER Share the hilarity!

Do you work in the IT industry and are forced to deal with inept and clueless end users on a daily basis? Do you have an IT professional, who isn't that 'professional'? If you have an interesting or amusing story, email us at contact@apctest.com. All correspondence becomes the property of *APC* and is subject to editing. Letters must include writer's full name, street address, suburb, state and phone number to be considered for print publication. Address and phone details will not be published.

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NVIDIA TAKES TITAN TO THE MASSES

The GPU giant's new 700-series flagships have landed, but how much of an upgrade are they really? Bennett Ring investigates.

Another year passes and another range of new graphics cards from Nvidia hits our shelves. It's just in the nick of time as well. The green GPU giant has been feeling the red heat of late, with AMD's Radeon series capturing gamer's hearts – and wallets – courtesy of new performance-boosting drivers, rock-bottom pricing and a collection of high-quality bundled games. Nvidia's solution to the AMD problem has been to go on the offensive with pure, unbridled power, releasing two new high-end products to introduce its GeForce GTX 700 series, in the form of the GTX 770 and GTX 780. The thing is, however, they're not really that new; they're essentially just tweaked versions of products that are already on store shelves.

THE GEFORCE GTX 770

Nvidia is a rather proud company and won't stand for being second best when it comes to performance. When AMD's Radeon HD 7970 overtook Nvidia's flagship GTX 680 product, courtesy of massive performance improvements via drivers early this year, it took Nvidia by surprise. Its answer was to release the GeForce GTX Titan, a $1,300 ubercard priced well out of reach of mere mortals and circulated in incredibly limited numbers. It blitzed the competition with excellent performance, although sales of this card are probably in the low thousands due to the astronomical cost. Nvidia needed another product that could take the fight back to the Radeon HD 7970, but wouldn't destroy gamers' wallets in the process. Enter the brand-new GeForce GTX 770, a product designed to provide a marginal increase over the Radeon HD 7970. Our review sample was provided by Gigabyte in the form of the GV-N770OC-2GD.

YOU CALL THAT AN INCREASE?

Powering this graphics card is Nvidia's GK104 GPU, the very same chip used in the Nvidia GeForce GTX 680. It has the exact same transistor count, used to create the exact same number of 1,536 CUDA cores (think of these as the cylinders in a car engine), organised into eight SMX units. However, this time around the speed of the GPU has been marginally increased, up from the GTX 680's base speed of 1,006MHz to a new base speed of 1,046MHz. It's a tiny bump, matched by a similarly small increase of the boost speed, which is reached while the card is under load. The GTX 680 boosted its core to 1,058MHz when running demanding games and the GTX 770 bumps that up to just 1,085MHz. Both of these frequency increases could be described as imperceptible outside of benchmarks – the area the GTX 680 loses out to the Radeon HD 7970. Gigabyte's version has experienced much more substantial frequency increases, with the base speed of 1,137MHz along with a boost speed of 1,189MHz. We can expect other manufacturers to follow suit, though Gigabyte historically squeezes some of the best performance out of Nvidia's GPUs.

MEMORY MATTERS

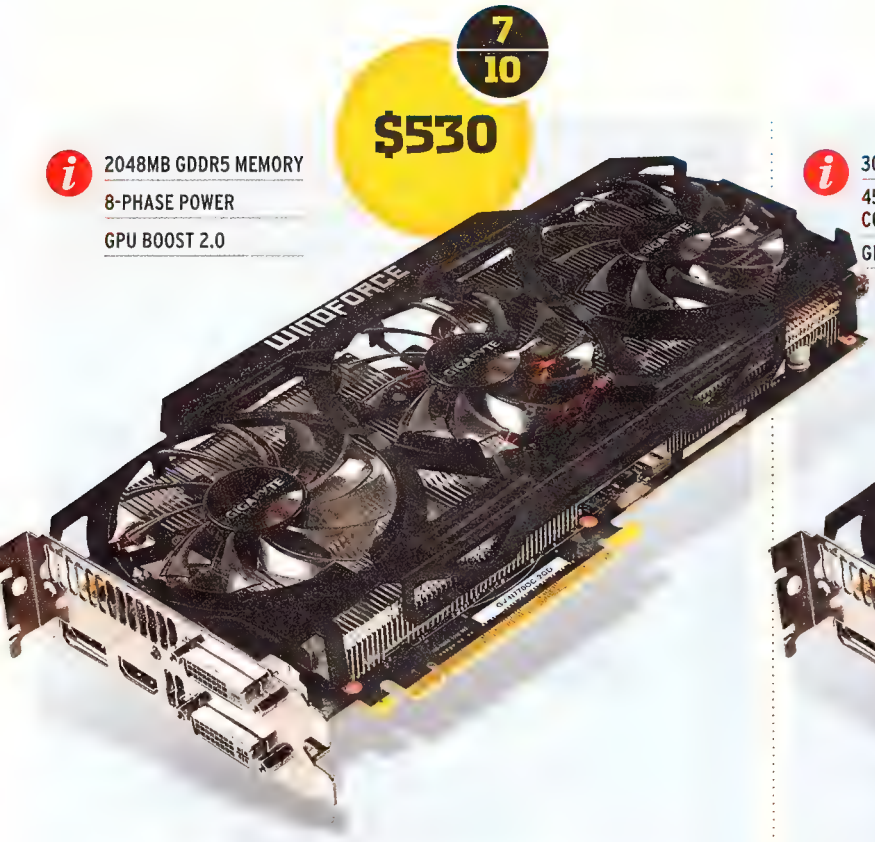
However, the memory of the GTX 770 has seen a much more significant performance improvement. Nvidia has decked out the GTX 770 with either 2GB or 4GB of GDDR5 running at 7,010MHz – a sizeable increase over the GTX 680's 6,008MHz. This area alone counts for most of the performance increase between the two cards.

Nvidia rolled out its new Boost technology with the first round of GTX 600 graphics cards and it's been improved for the new 700 series. Now called Boost 2.0, it automatically adjusts the frequency of the GPU based on the temperature of the chip, whereas the original Boost focused on energy use. This has resulted in slightly faster boost speeds, with even more room to improve if extravagant cooling methods are employed. That means water addicts will finally have a useful reason to build a custom water cooling loop over their expensive graphics cards.

Other than these two changes, it's business as usual. In effect, the GTX 770 is a slightly overclocked GTX 680 with faster memory and at launch it's been selling at around the same price the GTX 670 did – $500 to $600, with this Gigabyte model sitting at around $530.

THE GEFORCE GTX 780

The GTX 780 is a much more interesting proposition. Welcome to the little brother of Nvidia's GTX Titan. Beating at the heart of this high-end component is the very same GK110 slab of silicon that powers the Titan, but it's had some minor surgery to create a more affordable product. Like GK104, the GK110 uses Nvidia's SMX units to power its GPU, but this time around it has 12 of them, down two from the 14 found in the Titan. This means it's taken a slight cut in the number of CUDA cores – down to 2,304 from 2,688 – but that's still 50% more than the GTX 680. It's also had its compute performance massively reduced, so scientists won't be able to replace their expensive Titans with more affordable GTX 780s, though this'll make absolutely no difference to the average gamer. The drop in active CUDA cores means it pumps out



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8-PHASE POWER

GPU BOOST 2.0

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Whisper quiet, solid performer, excellent software suite.

Expensive compared to Radeon HD 7970.

9/10

$860

3072MB GDDR5 MEMORY

450W 'TRIANGLE COOL' COOLER

GPU BOOST 2.0

Gigabyte GeForce GTX 780 GV-N780OC-3GD

www.gigabyte.com.au

Almost as fast as Titan, whisper quiet, excellent SLI scaling.

Too expensive at launch.

slightly less heat than the Titan, which is probably why Nvidia increased the GTX 780's core speeds slightly. The base speed increases from 837MHz in Titan to 863MHz in the GTX 780, while the boost speed has increased from 876MHz to 900MHz. Once again, we see Gigabyte adding its own special sauce to the mix, increasing the base speed up to 954MHz, while the boost speed smashes the GHz barrier with a top speed of 1,006MHz.

To our surprise, the GTX 780's memory subsystem is basically identical to the Titan, using the same huge 384-bit memory bus and all 48 ROPs – the components used to ship data into and out of the memory. Just 3GB of memory is included this time around, however, which is down from the insane 6GB of Titan, but that's still more than enough for the craziest of resolutions and multiple-monitor displays. Nvidia has also equipped the GTX 780 with Boost 2.0 and we saw speeds of over 1.1GHz in certain circumstances on our Gigabyte GV-N780OC-3GD sample.

The biggest difference between the GTX 780 and Titan is pricing, but it appears once again that Aussies are going to pay through the nose compared to our American counterparts. Nvidia is suggesting retail pricing of just US$650, yet it appears the first crop to hit Aussie

THE GEFORCE EXPERIENCE

One of the most daunting things about PC gaming for newcomers is the plethora of graphics options offered by today's PC games. Unlike hardcore tweakers who love experimenting to find the best balance of image quality and performance, mainstream gamers just want to run their game knowing it looks as good as it can on a given set of hardware. To this end Nvidia has developed the GeForce Experience application, which examines a system's specs and then automagically adjusts the graphics options for every game found on the PC. No longer will gamers need to spend hours testing out new settings – just hit the 'Optimize' button and your game will be perfectly configured for your hardware. We spent several hours testing it and found it worked incredibly well. The vast majority of settings selected were appropriate for the system, with just the occasional value set a little too low for our liking. This software alone should make Nvidia's hardware that much more attractive to the masses.

shores will come in at around $850–900. Gigabyte told us they intended to hit a street price of $700 with our review sample, but the initial launch pricing was indeed $860. At this price, it's almost double that of Gigabyte's GTX 680 – a bit too high considering it only offers 50% more performance at most.

TESTING TIMES

As our benchmarks show, the GeForce GTX 780 isn't quite as mind-blowing in our selection as expected. It's definitely the fastest of the cards measured here, but considering the hefty price leap, it's not the kind of card that could be sold as good value for money. The GTX 770, on the other hand, finally gives Nvidia an affordable premium card that can outpace the AMD Radeon HD 7970 GHz Edition, if only by the slightest of margins. More impressive than the benchmark results is a measurement you couldn't see here – the fan noise. Both the GTX 770 and 780 remain whisper quiet under load, unlike the lawnmower in a case that is the Radeon HD 7970. Nvidia's focus on power efficiency really pays off if you care about fan noise.

If we go with the launch pricing of both products, we're left in a bit of a quandary. As usual, Aussies are forced to pay a much higher initial price than other countries, probably because we're known as being tech-loving big spenders. At these prices, you're really paying through the nose for the privilege of having some of the fastest hardware on the planet, with AMD's Radeon HD 7970 a much better value proposition. However, give it a few months and we should see the GTX 780 slide down to a $700 street price, while the GTX 770 should stabilise around the $450-$500 mark. At those prices AMD is in a bind – the GTX 770 offers better performance than the HD 7970 GHz, with cooler software features and lower fan noise, though it doesn't have the same killer bundle of games. The GTX 780 will offer most of the performance of Titan for around half the price.

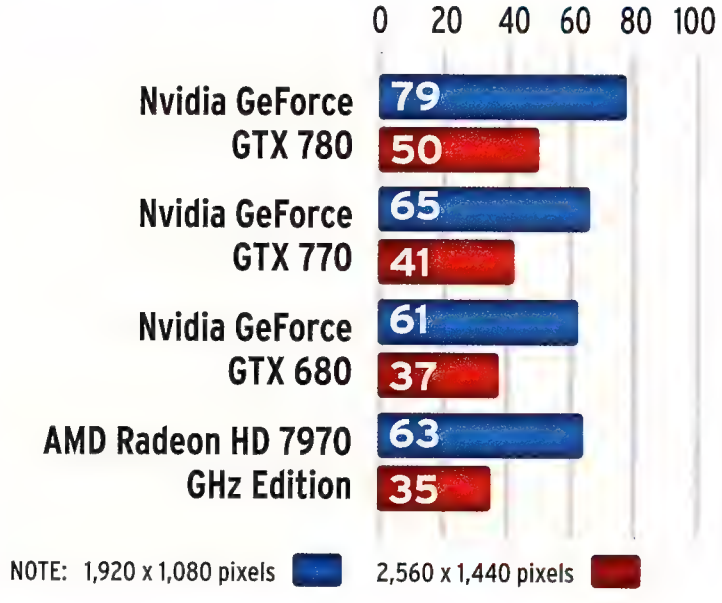
Until those prices drop, the smart money is still on AMD, but the red team's likely only got a couple of months before the situation down under changes dramatically. With news that AMD's Radeon HD 8000 series are simply rebadged, updated 7000 parts, it's unlikely it'll have anything that can go toe to toe with the GTX 780 this year. The really interesting game will be at the GTX 770 price point, where AMD's Radeon's architecture might still have room to compete. APC

EFFORTLESS GAME RECORDING

It's not available yet, but Nvidia is releasing game capture software with the 700 series. Called ShadowPlay, it leverages the powerful H.264 encoder built into all Kepler products to automatically capture the last 20 minutes of gameplay in a buffer, allowing you to save those special moments. Longer or shorter sessions can also be captured by manually changing the settings. Nvidia claims it's far less demanding than third-party applications, knocking just 5% off frame rates, but until we get our hands on the software we can't prove if this is true. The good news for owners of GTX 600 series cards is that it will also run on their hardware.

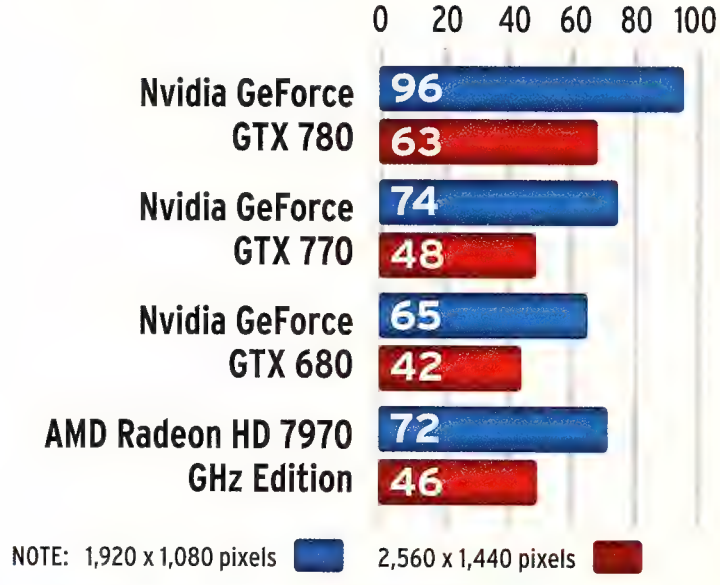
DIRECTX 11 GAMING PERFORMANCE

Shogun2: Total War (ultra detail, avg fps)



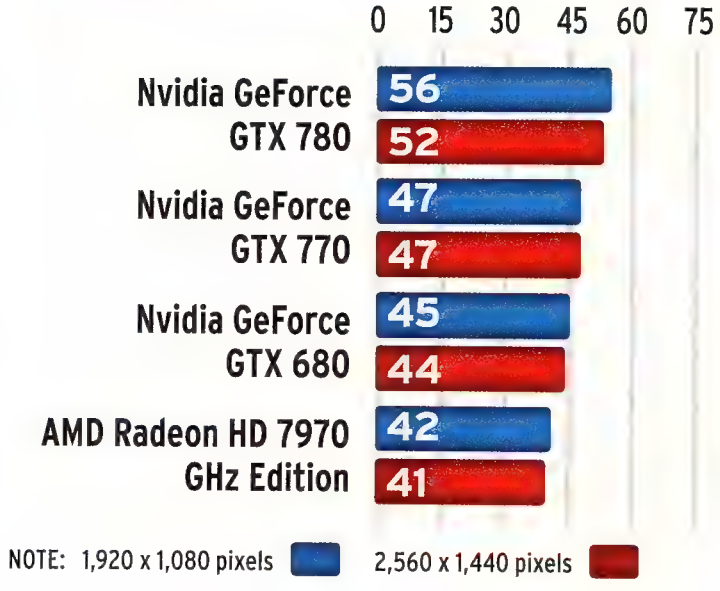
DIRECTX 11 GAMING PERFORMANCE

Battlefield 3 (ultra detail, avg fps)



DIRECTX 11 GAMING PERFORMANCE

Far Cry 3 (ultra detail, avg fps)



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Anyone still coming?!
Where is everyone??
Is Tuesday lunch good for you?
When do we meet up?
Have we decided yet?
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I give up, let's postpone this.
Where are we meeting?
Need to make a choice.
Can everyone please RSVP?

7/10

AMD Radeon HD 7990

Serious AMD engineering, but is it too late to the ultra-enthusiast party?

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Even with the launch of the new GTX 770 and 780 cards, it's hard to argue that the graphics card market hasn't been moving at a slower pace than it used to. We've still been seeing new cards released on a regular basis, but they're mostly rebadged or tweaked versions of existing hardware.

Whether we're talking about ultra-enthusiast graphics cards like the GeForce GTX Titan or lower-end parts like the AMD Radeon HD 7790, we're not really seeing new technology – just different ways to package it for the consumer. And here we have another sparkling new card, though it's one we've actually already seen elsewhere in some guise or another.

This time it's AMD getting in on the ultra-enthusiast segment, having given its AIB partners a little time in the sun with its own dual-GPU, Tahiti-based cards. "We've helped our partners with these products," said AMD's Devon Nekechuk at a recent briefing. "We actually put a lot of focus helping them develop parts of these cards. We've designed parts of the Ares II and Devil 13 in partnership with ASUS and PowerColor. We want to jump in this game, too."

AMD is now releasing its own spin on the CrossFireX card, codenamed Malta: the Radeon HD 7990. Yes, we're talking about a new graphics card and at $1,300 it actually costs more than a GTX Titan. But that should come as no surprise, given the fastest graphics card in town, the dual-GPU ASUS Ares II, costs around $2,000 on its own.

If AMD's Radeon cards are sitting atop the graphics card tree, why is AMD so keen to throw its own version into the mix, especially as it's already helped design parts of its partners' cards? "The core of this thing is that we set out to add to the family of the world's fastest graphics card. We wanted to create another product worthy of the HD 7990 brand to make sure we can cater to that market of people who don't buy graphics cards for utilitarian purposes," says Nekechuk. "They really want to create a Ferrari or a Lamborghini of a PC. They have that emotional attachment and they want the ultimate graphics card."

So, we're back to manufacturers banging the form-over-function drum, claiming people with the cash for ultra-enthusiast cards aren't necessarily after the outright fastest card, but want the best experience of ownership. We're not buying into this argument when we're talking about multi-GPU cards. With the vagaries of CrossFireX and SLI, you're almost guaranteed to have to get your hands dirty fixing multi-GPU problems with the latest games at some point, and single cards packing in a pair of GPUs tend to suffer more problems.

ANTI-UTILITARIANISM?

For all of Nekechuk's talk about not going after the somewhat utilitarian concept of speed at all costs, AMD has included some serious hardware at the heart of this new card. As you'd expect from its partners' existing HD 7990 designs, there's a pair of Tahiti XT GPUs burning away below those chunky heatsinks and AMD has apparently been hoarding the fastest chips off the production line for its baby.

"[We've been] putting aside the best of the best HD 7900 series parts and saving them for the HD 7990s," said Nekechuk. "So these are the lowest power parts – these are the fastest parts." And these parts are given a base clock of 950MHz, though with the extra boost AMD has created, aping Nvidia's GPU Boost, they generally knock around the 1GHz mark in most tests.

There's also a healthy 6GB chunk of GDDR5 memory split between the GPUs to make up the card's framebuffer. The VRAM clocks in at 6Gbps, as has become standard with

high-end graphics memory. AMD reckons that gives it over 500GB/s of bandwidth for shunting data between the GPUs "to really cope with those ultra-high-resolution, ultra-high framebuffers". To keep the GPUs talking clearly, AMD has also jammed in the latest PLX PCIe chip into the card, which offers some 48 lanes of PCIe traffic. That gives the card almost 100GB/s of inter-GPU bandwidth, perfect when they're talking with each other or communicating outside to the system bus.

And when you're jamming in a pair of the fastest cores AMD can manufacture, you're going to have to think pretty darned hard about the cooling of this multi-GPU card. Thankfully, that's something AMD has spent a good chunk of time on and that's mostly down to the impressive engineering Nvidia put into the GTX Titan. "Nvidia – I won't do this very often – I'll give them credit on the Titan. They made a quiet card," said Nekechuk. "But that just gave me a target. I'm not going to sit idle; I'm going to look at that Titan and say, 'They did a good job. I can do better.'"

AMD has done a very good job. On our test rig, the water pump in the closed-loop CPU cooler was making all the noise – even when we had the 7990's GPUs at 100% load.

We have to say, it doesn't look like much on the surface. There are three shallow fans spinning atop a mass of copper piping and aluminium heatsinks. The HD 7990 sticks around the 80°C mark resolutely when it's being really pushed and even then it stays incredibly quiet.

It's by no means silent, but AMD has spent time working on the tone of the sound it produces when the fans are spun all the way up. You can hear it, but the gentle rush of air has none of the whine or harshness that you get from standard HD 7970 GHz cards or even the GTX 690. AMD has also managed to keep the impressive cooling down to a dual-slot array, smaller than the triple-slot beasts we've already seen.

GAME ON?

So what of performance? It's pretty damn impressive for a single-PCB/multi-GPU card. The first and perhaps most important thing to say is that it beats the GTX 690 and GTX Titan in our performance metrics almost across the board. The only place where Nvidia held sway was in the *Batman: Arkham City* test, where Nvidia generally performs better.

Even more impressive is the fact that it stays above both the Nvidia cards in terms of the minimum recorded frame rate, too. That's always a good indicator of how smooth a gaming experience you're going to get.

What this card doesn't do is beat a CrossFireX pairing of twin HD 7970 GHz edition cards. That setup is $300 cheaper, making the HD 7990 a bit of a tough sell. That's why we had all the talk from Devon Nekechuk about not going for the utilitarian option – if you're after sheer AMD performance, that CrossFireX pairing wins. Where they fall down is experience: when pushed to their limits, a pair of HD 7970 GHz cards make one hell of a racket; however, they're blisteringly quick and smoother than this HD 7990.

So, the HD 7990 doesn't win the performance battle. AMD says it was never meant to, but in experience terms, we wouldn't call it a win either. As effective as the cooling is, it's never going to have the premium aesthetic of the GTX Titan. In graphics card terms, it looks like a super car – it's practically got alloys. And if we take straight-line performance out of the equation and go for that experience angle, a multi-GPU card is never going to be able to compete against a simple, single-GPU card, especially one that's a little cheaper and only a bit slower in most cases.

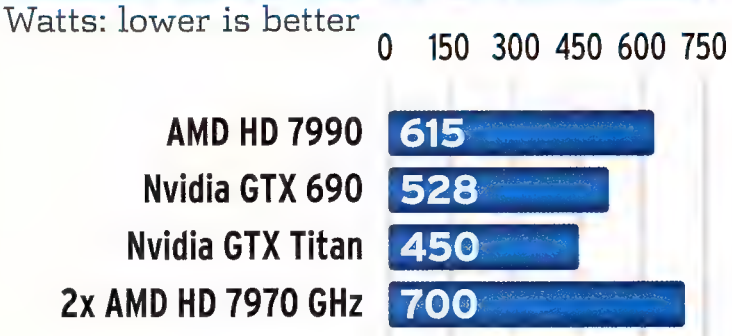
Sadly, the HD 7990 is one of the flakiest cards we've tested in a long while. We were finally able to coax some impressive performance figures out of it, but only after a good long while of sometimes only having a single GPU turning up to the benchmarking party. This is no doubt down to the early drivers we had to use for pre-release testing and not the hardware itself, but that's a plain reminder of the vagaries of multi-GPU gaming. When you fire up a new game on your CrossFireX or SLI rig, you'll always be wondering whether one or other of your GPUs has gotten confused and wandered off somewhere else.

As impressive a feat of engineering as this beast is, there are faster, smoother and cheaper graphics arrays available, and arguably better enthusiast 'experiences' to be had elsewhere.

Dave James

PEAK PLATFORM POWER DRAW

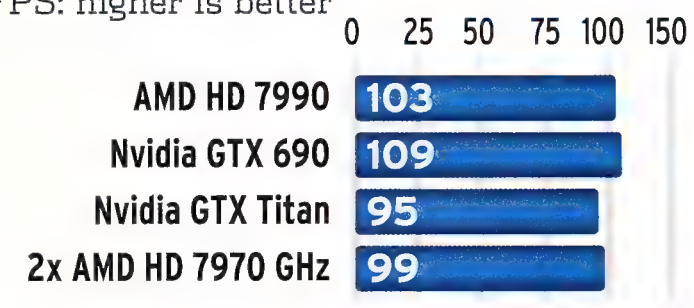
Watts: lower is better



DIRECTX 11 GAMING PERFORMANCE

Batman: Arkham City

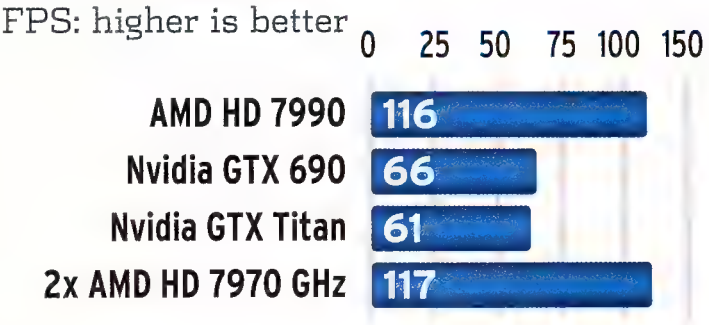
FPS: higher is better



DIRECTX 11 GAMING PERFORMANCE

DiRT Showdown

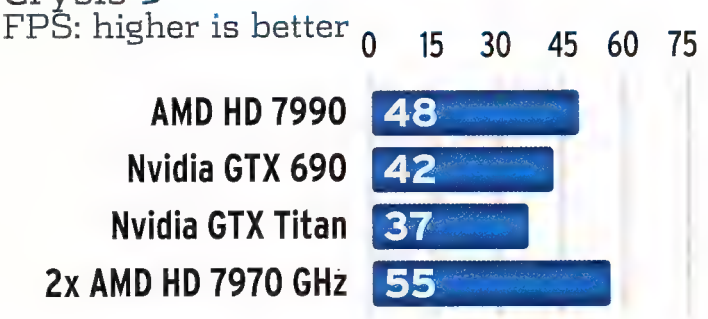
FPS: higher is better



DIRECTX 11 GAMING PERFORMANCE

Crysis 3

FPS: higher is better



9/10 Corsair Vengeance M95

The best-in-class MMO mouse gets a tuneup.

MOUSE

www.corsair.com @

$79 $

Solid build quality, ergonomic, affordable. ✓

Almost identical to the M90, not the smoothest glide pads. ✗

Let's face it: you need a lot of faith in your right hand to invest in a high-performance gaming mouse like this (sorry, we refuse to acknowledge you devil-spawn lefties). Are you going to use all of those 15 programmable buttons? Will you feel the difference that an 8,200dpi tracker makes over the more commonly found 5,200dpi?

Regardless of exactly how you use it, you're still going to enjoy the Corsair M95 a lot because, as ever, its build quality and attention to detail make it a luxurious and reliable rodent to have under your hand.

The mouse is built around an aluminium chassis and is finished in glossy plastic, rather than the matte texture you'll likely be accustomed to. The metal frame gives the M95 (like the cheaper Corsair M-series mice) a satisfying weight and even distribution, and in the middle is a solid metal scroller with a rubberised finish.

It excels ergonomically, too, despite lacking the adjustable panels of the R.A.T. range from Mad Catz. And what of that gloss finish? Well, it won't stop your palms a-sweatin', but it'll at least make the repulsive (and somewhat inevitable) hand gunk easier to wipe off.

If there's an elephant in the room, it's that the M95 is almost identical to the M90, which was released just over a year ago. What's actually changed? Aside from the white colour scheme and finish, very little. As we mentioned earlier, the dpi count has increased from 5,200 to 8,200 and the eight buttons surrounding your thumb are slightly softer to the touch, feeling less likely to stick or break. This wasn't a massive issue with the original M90, frankly, so we're thankful although slightly bewildered by such an incremental upgrade.

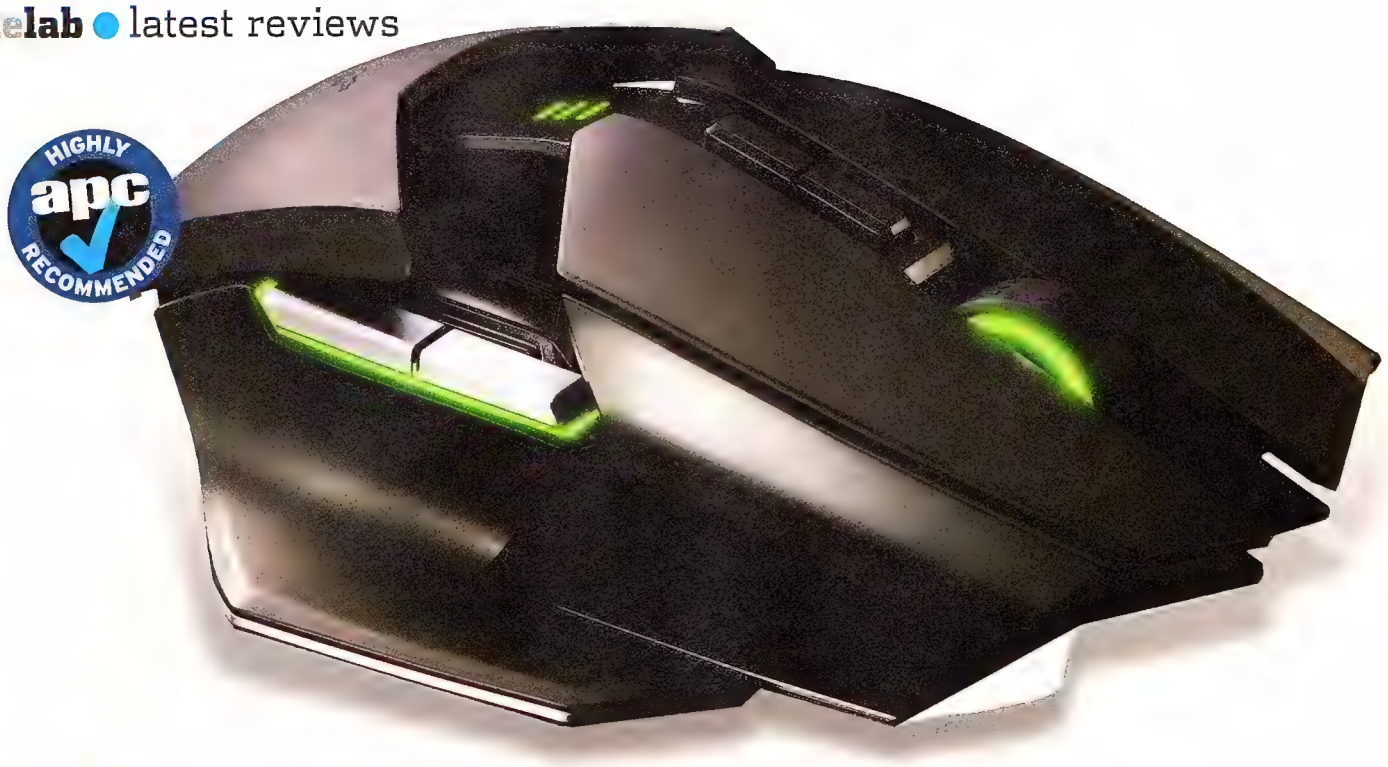
Those buttons are the M9X series' big selling point. They're certainly handy in a command-heavy MMO or RTS and even in a relatively simple yet mouse-centric game like *Diablo III*, they take all action commands away from the keyboard and place them just under your thumb. You can also record macros and game-specific profiles with them and they're stored directly on the mouse for minimal fuss.

It's hard to fault the M95, with its bright lights and concept car visuals. If there's any area that left us faintly underwhelmed, it was the relative lack of glide in its PTFE glide pad feet. Comparatively, the R.A.T. chassis have a satisfying agility that's yet to be toppled.

However, we're talking about something you'll probably only notice in a fast-paced shooter, not in the kind of strategic maelstrom that requires macro keys. Oh, and if we're being really picky, we love to see a free-spinning option on the mouse wheel, which few gaming mice offer.

So once again, Corsair's great build quality comes up trumps. It's not the apex of performance pointing, but it's damn close and affordably priced, too. Perhaps it's not quite twitchy enough for the really hardcore FPS gamers, but for anyone who doesn't routinely teabag their enemies on the battlefield, this top-quality mouse comes highly recommended.

Phil Iwaniuk



8/10 Razer Ouroboros

All of Razer's eggs in one sexy, black, magnetic basket.

GAMING MOUSE

au.razerzone.com @

$130 $

Gorgeous industrial design, mostly accurate and powerful mousing. ✔

Some cursor jitter in wireless operation, can be tough to access the 'back' button, expensive. ✖

This isn't the first ultra-configurable mouse we've taken for a spin. Cyborg has been pumping out its *Transformer*-esque R.A.T. series of mice for a few years now and more recently, we got our paws on the BMW/Thermaltake offering in the Level 10 M Gaming Mouse. All of these mice offer similar abilities to tweak the chassis' shape and size with an included tool. However, we've found that this generally offers more aesthetic/engineering appeal than actual mousing comfort and performance. A user-configurable chassis is a niche within a niche market and why Razer – a company more comfortable reissuing popular (read 'profitable') older models instead of taking actual risks – would want to tap into this market is a little perplexing. Why try to reinvent the mouse wheel now? After tinkering with the Ouroboros for our review, the answer to that is actually pretty simple: everyone else has been doing it wrong the entire time.

From an industrial design standing, the Ouroboros is an evolution of the (much-loved by us) Taipan and features the same durable matte plastic finish, a similar curved profile and side button/scroll wheel design, alongside the same vented Batmobile-inspired angular front end. It's a slick-looking package which, thanks to clever design and magnets, doesn't sacrifice sex appeal to pack in the same configuration options as its unapproachable industrial peers. Included in the box are four additional side panels: a left and right wing as well as the more traditional flat back option, which can be mixed, matched and attached via magnets on the mouse flanks. There's also a quick-release button and scroll wheel on its heel that moves and tilts the back to add 15mm of length and fill any palm gaps in your grip. The tool-free manipulation means switching and comparing between different configurations to nut out your ideal setup is far quicker than on the competition. The USB powered receiver also acts as the single AA cell recharger when the mouse is docked and the braided USB cable can be plugged directly into the Ouroboros if a wired connection is preferred (more on that in a minute).

Under the bonnet, the Ouroboros features Razer's new 8,200dpi 4G Dual Sensor System, which is basically an optical and laser sensor working together to track the cursor (at 1ms wireless response rate and 50g acceleration) as well as continually calibrate itself to the mousing surface. So in theory, lag-free wireless gaming. Taking it for a spin through its paces in *DayZ* alongside *Battlefield 3*'s single-player campaign as well as some **Caspian Border** multiplayer, it's here that some performance cracks started to show. Tracking the mouse across the screen and general in-game navigation is fine, but we experienced cursor jitter when it came to more precise needs like marking targets or scoping with a sniper rifle. It even jittered when sitting the mouse hands-free on the desk(!) and changing to a fresh battery didn't lessen the pain. Obviously it's not an ideal solution for a wireless mouse, but the Ouroboros became jitter-free and nearly perfect when ignoring the wireless functionality and tethering with the USB cable.

Speaking of limitations, while a little savvy shopping will find this gaming mouse for under $130, it's difficult to swallow Razer's RRP of $200. The Ouroboros runs on the proprietary Synapse 2.0 software, too, so you'll need an internet connection and registration to finalise the setup process – that includes access to the drivers and sensor and cosmetic lighting configuration options – or the mouse just won't work.

We've always thought wireless technology was on thin ice in a gaming arena; it's not always perfect and when lag and bugs are enough of a frustration, the last thing you need to worry about is whether your mouse is about to fall over. If you absolutely need to head into wireless territory – and you have the cash to splash – the Ouroboros is certainly as good as it gets.

Troy Coleman

9/10 HTC One

Number one indeed.

SMARTPHONE

www.htc.com/au @

From $62/month on a 24-month contract $

Great build quality, camera works well, fast and responsive. ✔

BlinkFeed can't be uninstalled, no expandable memory. ✖

Though it does dabble in Windows phones, HTC's best known for its Android handsets and though it's been a while since it's had a real hit on its hands, with the One it manages that feat with aplomb.

The design of the metallic One is sublime. It fits neatly in the hand without being too slippery and at 143g with a 4.7-inch 1080p 468ppi display, it's a pleasure to use. The underlying 1.7GHz Snapdragon 600 quad-core CPU and 2GB of RAM deliver smooth performance; we tested it with Geekbench 2 at 2,735. There's no microSD memory slot built into the One, which is mildly disappointing.

HTC's done a few controversial things with the One. Its use of a 4MP camera with larger pixel sensor sites and correlating Zoe software works better than you might expect, especially in low light. Where it does suffer a little is if you want to digitally crop or blow up your photos – because they're still only 4MP images, they can lose out against other camera options. HTC's BlinkFeed, on the other hand, gives you a Flipboard-style home screen, but it's not a feature we're captivated by. While you can't uninstall it, you can at least set your home screen to other screens instead. There's no menu button, which means it either pops up virtually in some apps or relies on a double-tap of the 'Home' button on others.

The One is a fine achievement in smartphone design and easily the best smartphone that HTC's ever produced. It's also – in the current market – easily the phone we'd recommend you buy over the existing smartphone incumbents.

Alex Kidman

8/10 Samsung Galaxy S4 4G

Blazing fast but a little bloated.

SMARTPHONE

www.samsung.com/au @

$899 $

Insanely fast, lots of installed apps. ✔

Limited onboard storage, many embedded apps are useless, cheap plastic build. ✖

Samsung's latest flagship is very much a Galaxy phone, with a familiar and cheap-feeling plastic build. The layout is virtually identical to the S III and Samsung's thrown a ton of software at it, which when married to its quad-core 1.9GHz processor, makes it a bit of a beast.

That's borne out by its exceptional Geekbench score of 3,167, making it the fastest smartphone you can buy. The 441ppi 1080p Super AMOLED screen has excellent display characteristics and battery life is quite solid for a 4G LTE device.

However, there are issues. All that software eats away at the 16GB of onboard storage – you end up with less than half at your disposal. Some features (such as 'Air Gesture', 'Smart Pause' and 'Smart Scroll') only barely work and even then, only within Samsung's own apps. 'S-Translate' promises live translation, but does so word by word, robbing sentences of their context. On Australian handsets part of the UI is also locked, so you can't change the bottom row of icons on the home screen without using a third-party launcher. Despite its benchmark superiority, there are areas where actually using the S4 feels sluggish in comparison to handsets such as the HTC One.

The S III sold insanely well, but the differences between it and the S4 don't pan out if you're looking to upgrade. If you're just after a new premium smartphone, the S4 is good, although there are now better-designed, slicker alternatives that perform just as well.

Alex Kidman

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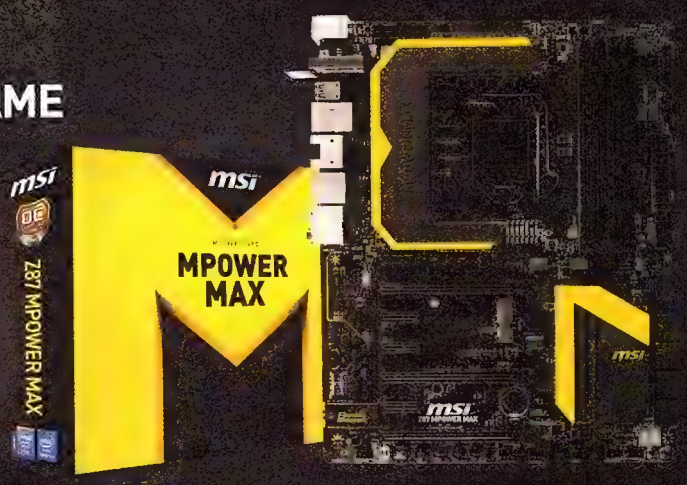

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MSY Technology	Tel: 03-9560 2288	msy.com.au
Budget PC	Tel: 03-9541 9000	budgetpc.com.au
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PC Case Gear	Tel: 03-9560 2122	pccasegear.com.au
Scorpetc Computers	Tel: 03-8561 3206	scorptec.com.au
QLD		
MSY Technology	Tel: 07-3217 9070	msy.com.au
Computer Function	Tel: 07-3270 4477	computerfunction.com.au
FTC Computers	Tel: 07-3344 7100	ftc.com.au
Gamedude Computers	Tel: 07-3387 1500	gamedude.com.au
Gocomp	Tel: 07-3722 5150	gocomp.com.au
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6/10 Thermaltake A31 Chaser

A bargain chassis.

PC CASE

www.thermaltake.com.au

$99

Clear side panel, seven expansion slots, two fans provided.

No anti-vibration material included, flimsy plastic drive cages.

The latest addition to Thermaltake's extensive range of cases is this A31 Chaser. It's aimed at gamers and enthusiasts alike, and comes in a couple of different guises. There's the classic black job, which we're looking at here, plus the Thunder Edition, which is blue, and the Snow Edition, which is white.

The A31 Chaser comes with a clear side panel as standard. Thermaltake has chosen to use screws to fix the Perspex, so if you really need a cooling fan in the side, you can unscrew the window without resorting to a Dremel and/or hacksaw to do a touch of DIY and/or butchery.

One surprising omission is found (or rather, not found) in the bottom of the case, where the PSU sits. Usually in a case of this class – and quite a few cheaper ones, for that matter – there's some form of anti-vibration material fitted to the PSU mounts. Not so in the A31, which in our opinion is an odd (and quite frankly miserly) choice for a chassis costing this much. Also, the only true dust filter is the long, removable one on the underside of the case.

Thermaltake hasn't been generous with the cable access slots in the motherboard back plate either. There are just three rubber-grommeted slots, but they're quite long and in the right places for getting the main power cable and data cables to and from the motherboard.

The A31 Chaser provides support for three 5.25-inch and six 3.5-inch drives. The three 5.25-inch drive bays have tool-free mounts, but sadly the 3.5-inch drives trays don't. You'll have to screw your hard drives to the trays, although they can be jammed into the drive cage without tools. The six bays are split between two cages, with the top cage being removable to allow space for a well-endowed graphics card. Rather disappointingly, the drive trays themselves are made of plastic and feel a little flimsy, but they're versatile and can hold either 3.5-inch or 2.5-inch drives.

Two 120mm 1,000rpm fans provide the case cooling: one housed in the bottom of the front panel and the other on the rear panel. For extra cooling you can install another 120mm fan in the front panel and a similarly sized unit in the case floor. The mounts in the roof of the A31 support either two 120mm or two 140mm fans, or a 240mm radiator for liquid chilling. Thermaltake's A31 Chaser is a fairly well-built chassis, but we can't help feeling that there are a few too many nods towards cost cutting. The plastic drive cages seem a little flimsy and the lack of simple touches, like noise-dampening detailing around the PSU mounts, make it feel like it was designed as a bit of a throwaway case. That's a shame because otherwise it's a decent chassis. Cooler Master and Fractal Design offer cases with better specs for similar cash.

Simon Crisp

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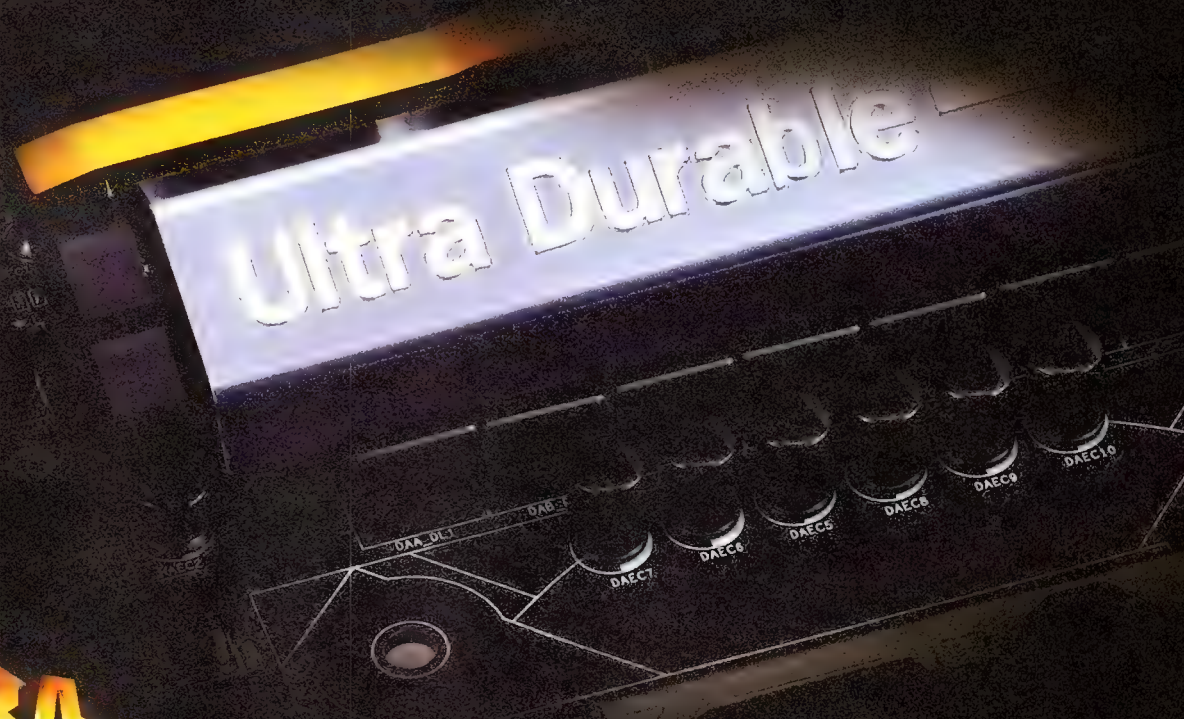

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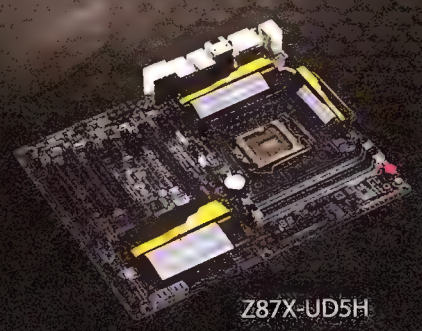
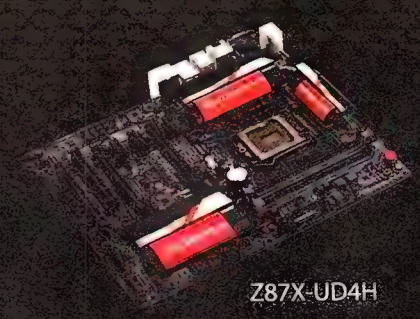


Z87X-UD5H



Z87X-UD4H

Z87X-UD3H

ULTIMATE SSD GUIDE

Building or upgrading your computer with an SSD? Darren Yates's guide shows you tweaks to improve your system's performance and the tweaks to avoid.

While having a fast processor will always be a core requirement to improving your PC's performance, few components deliver the sort of system response gains we've seen from solid-state drives (SSDs). An SSD can't make your PC's processor crunch instructions any faster, but it can significantly reduce the time it takes for data to move around your system by offering lightning-quick data transfer speeds compared with traditional platter-based drives. But that doesn't mean there's nothing more you can do at your end to improve your SSD's performance. There's plenty of information on the web that purports to offer advice on system-wide SSD tweaks. Some of them work, but some we think are seriously questionable. Our guide include tweaks that we'd use as well as tips you should steer well away from. Best of all, you don't need to rely on any apps to perform these tweaks.

APC'S SSD PERFORMANCE TIPS

TIP 01 Set BIOS to AHCI SATA mode

Right off the bat, let's start with some controversy. Advanced Host Controller Interface (AHCI) is a SATA mode originally designed to enable faster hard drive performance by including native command queuing (NCQ). It's also often claimed as a requirement to enable TRIM support, the OS-led SSD rubbish cleanup mechanism that reclaims unneeded storage blocks and restores performance levels.

The problem is the claim isn't true – you don't need AHCI to enable TRIM support. TRIM can run in AHCI or IDE SATA modes. What using AHCI mode does is automatically enable TRIM support through the Windows AHCI driver software.

However, NCQ is more controversial. SSD brands such as Corsair routinely recommend the use of AHCI mode when running SSDs (**tinyurl.com/ndls6do**). Motherboard maker MSI has a controversial post suggesting AHCI does nothing for SSDs. Further, it says NCQ could actually contribute to SSD wear (**tinyurl.com/o9w53qt**). When reading up on SSD optimisation, you should know that no-one agrees on anything.

Personally, we'd trust the SSD manufacturers to know their stuff. Sufficient evidence in performance tests suggest that even if it's not NCQ specifically, there's something in AHCI that does help improve SSD performance and that's good enough for us.

SETTING UP AHCI SATA MODE

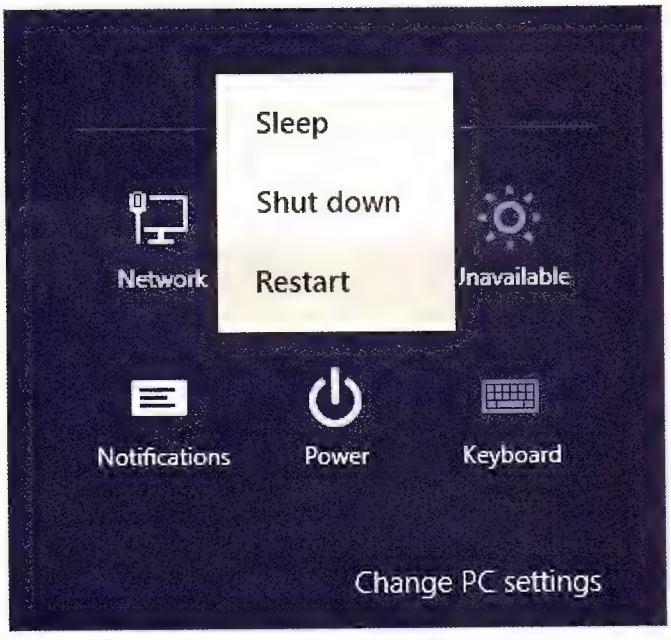
Ideally, you set the SATA mode in the motherboard BIOS before you install your OS. (Interestingly, you don't find the IDE/AHCI SATA mode option in most laptops, so we'll assume they automatically lock into AHCI mode.) Consult your motherboard manual for specifics, but it's normally a case of simply choosing between the IDE, AHCI or RAID, setting the mode to AHCI, saving the changes and rebooting. From there, you install your operating system in the usual way.

SETTING UP AHCI AFTER OS INSTALLATION

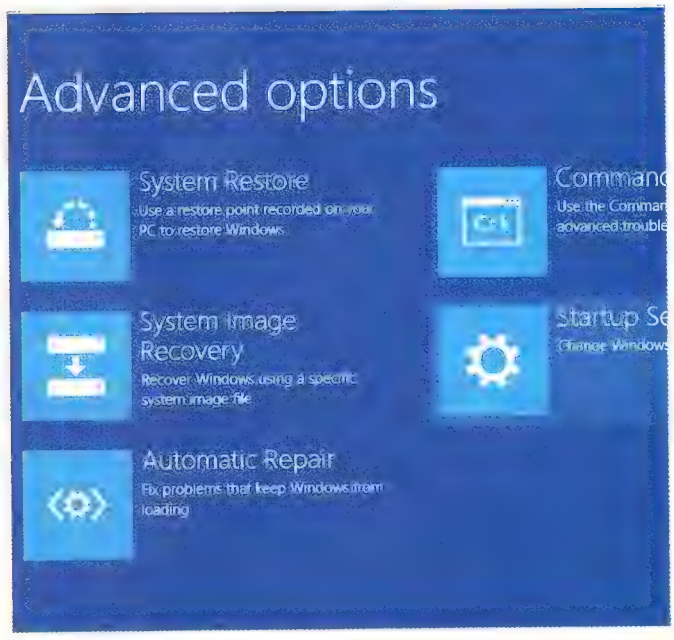
It gets trickier to change the SATA mode if you've already installed the OS. If you simply go into the motherboard BIOS and change the SATA mode from IDE to AHCI, your system will likely get stuck in a crash/reboot loop. It can be fixed, though. If you're using Windows Vista or 7, you can make a change to the registry right before you reboot and change the BIOS setting. Windows 8 users don't even need to do that – the new shutdown/reboot menu has an option to force the next reboot into safe mode. If you reboot after you make your BIOS changes, Windows 8 will load in the AHCI drivers when you boot into safe mode. Do that, reboot normally and you're good to go.

SET AHCI MODE IN WINDOWS 8

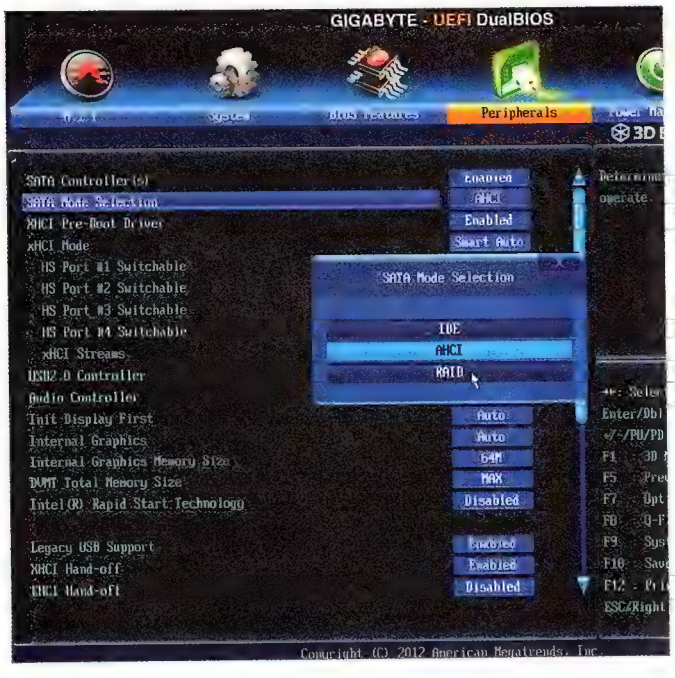
Do it in just four easy steps.



01 After installing Windows 8, use the 'Restart' option in the Windows 8 Charms Bar and hold down the left Shift key as you do.


Advanced options
System Restore
Use a restore point recorded on your PC to restore Windows
System Image Recovery
Recover Windows using a specific system image file
Automatic Repair
Fix problems that keep Windows from loading

02 In a few seconds, you'll see the 'Choose An Option' screen. Select 'Troubleshoot > Advanced Options > Startup Settings', then click the 'Restart' button.



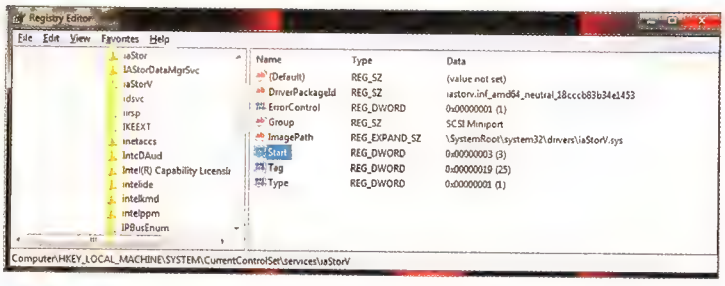
03 Boot into your motherboard's BIOS and change the SATA mode from IDE to AHCI. Consult your motherboard manual for full details. Once that's done, reboot.

Startup Settings
Press a number to choose from the options below
Use number keys or functions keys F1 F9
1) Enable debugging
2) Enable boot logging
3) Enable low-resolution video
4) Enable Safe Mode
5) Enable Safe Mode with Networking
6) Enable Safe Mode with Command Prompt
7) Disable driver signature enforcement
8) Disable early launch anti-malware protection
9) Disable automatic restart after failure
Press F10 for more options
Press Enter to return to your operating system

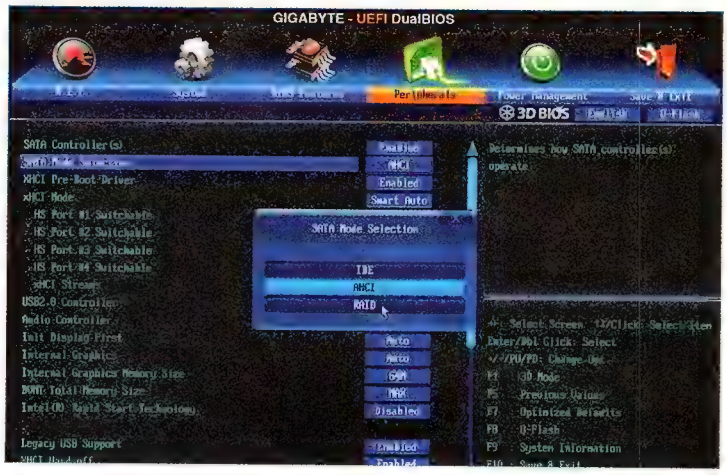
04 This will bring up the 'Boot Options' menu. Select 'Enable Safe Mode' by pressing the 4 or F4 key. Once you arrive in Windows Safe Mode, reboot normally and your PC will be using AHCI mode.

SET AHCI MODE IN WINDOWS VISTA OR 7

Faster hard drive performance awaits.



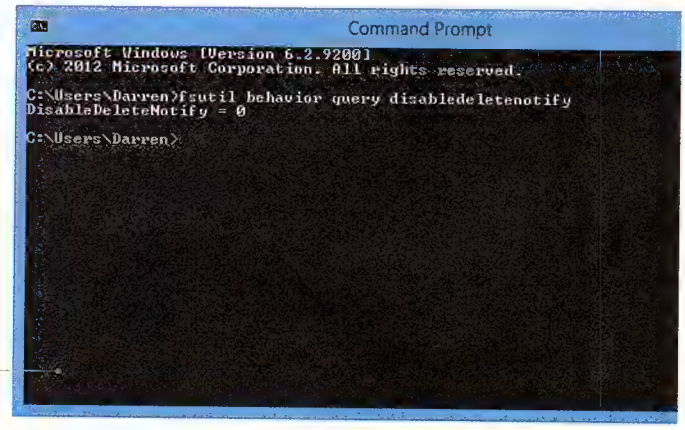
01 Boot up your PC, press Windows key+R, type **regedit** and press Enter. Look for the key HKEY_LOCAL_MACHINE\System\CurrentControlSet\Services\ and either of the subkeys **msahci** or **iaStorV**. Look for the 'Start' entry and change the value to **0**. Click 'OK', shut down and reboot your PC into the motherboard BIOS (check your motherboard manual for details).



02 Change the SATA mode of your drive from IDE to AHCI, save changes and reboot normally. Your PC should now be running in AHCI mode. If it doesn't boot, change the SATA mode back to IDE in the BIOS and try the alternate subkey. For more information, check out **support.microsoft.com/kb/922976**.

TIP 02 Ensure TRIM is enabled

Windows 7 and 8 computers should automatically activate TRIM support by default if you're using AHCI mode (whether you're using an SSD or not – HDDs just ignore it), but there's a simple way to check: hit Windows key+R, type **cmd.exe** and press Enter. When the DOS prompt box appears, type **fsutil behavior query disabledeletenotify**. If the result is **= 0**, TRIM should be working correctly. If you have a **= 1** result, replace the text above with **fsutil behavior set disabledeletenotify 0**, press Enter and this will enable TRIM. It's highly unlikely you should need to do it, particularly if you've installed Windows onto the drive set to AHCI mode already, although it doesn't hurt to check.



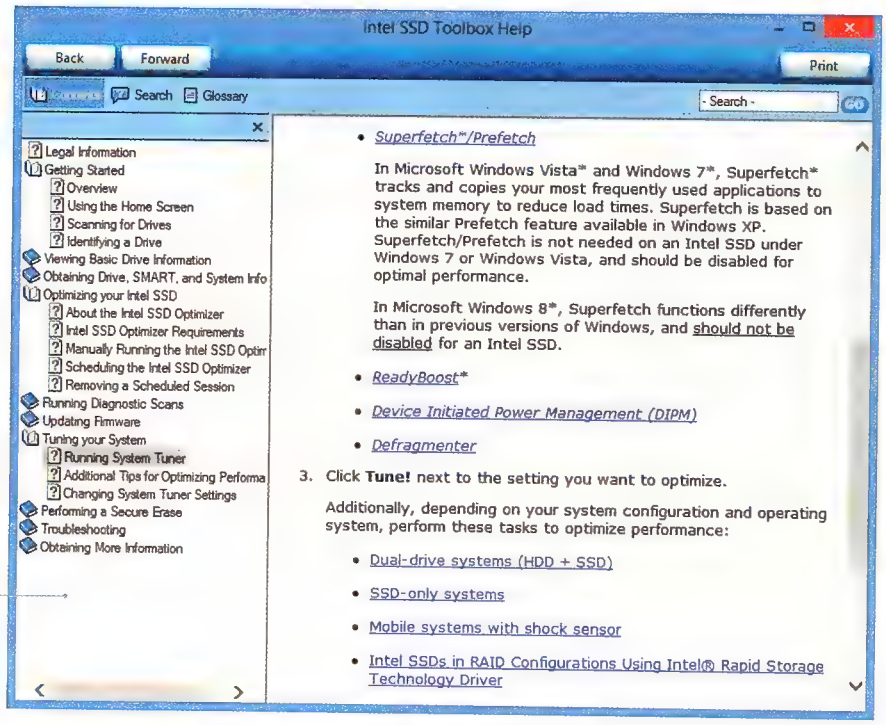
TRIM should be on by default in Windows 7/8, but you can check it with a DOS prompt command.

TIP 03 Turn off SuperFetch/Prefetch

Another controversial option is turning off the SuperFetch function. SuperFetch is a Windows subsystem tool that preloads system RAM with commonly used files. The idea behind it is that if they're commonly used, you store them in RAM to speed up their access and help Windows run smoother. The word is it doesn't help SSDs, so the general belief is that it's better to turn it off – queue more controversy.

Some sites go out of their way to debunk this as utter rubbish, but it's a little more complicated than that. Intel actually recommends you turn it off if you're using an Intel SSD and running Windows Vista or 7. We took this screenshot (right) from Intel's latest SSD Toolbox help manual; interestingly, it recommends leaving SuperFetch on in Windows 8 because of changes Microsoft made to the way SuperFetch works in its latest OS.

All that said, according to Microsoft's former Windows guru, Steven Sinofsky, Windows 7 and 8 turn off SuperFetch (and the ReadyBoost feature) automatically. You can read about it at **tinyurl.com/2u9v8g4**.


Intel SSD Toolbox Help
Back
Forward
Print
Search
Glossary
- Search -
Legal Information
Getting Started
Overview
Using the Home Screen
Scanning for Drives
Identifying a Drive
Viewing Basic Drive Information
Obtaining Drive, SMART, and System Info
Optimizing your Intel SSD
About the Intel SSD Optimizer
Intel SSD Optimizer Requirements
Manually Running the Intel SSD Optimizer
Scheduling the Intel SSD Optimizer
Removing a Scheduled Session
Running Diagnostic Scans
Updating Firmware
Tuning your System
Running System Tuner
Additional Tips for Optimizing Performance
Changing System Tuner Settings
Performing a Secure Erase
Troubleshooting
Obtaining More Information
Superfetch*/Prefetch
In Microsoft Windows Vista* and Windows 7*, Superfetch* tracks and copies your most frequently used applications to system memory to reduce load times. Superfetch is based on the similar Prefetch feature available in Windows XP. Superfetch/Prefetch is not needed on an Intel SSD under Windows 7 or Windows Vista, and should be disabled for optimal performance.
In Microsoft Windows 8*, Superfetch functions differently than in previous versions of Windows, and should not be disabled for an Intel SSD.
ReadyBoost*
Device Initiated Power Management (DIPM)
Defragmenter
3. Click Tune! next to the setting you want to optimize.
Additionally, depending on your system configuration and operating system, perform these tasks to optimize performance:
Dual-drive systems (HDD + SSD)
SSD-only systems
Mobile systems with shock sensor
Intel SSDs in RAID Configurations Using Intel® Rapid Storage Technology Driver

Intel recommends ditching SuperFetch on Windows 7, but not on Windows 8.

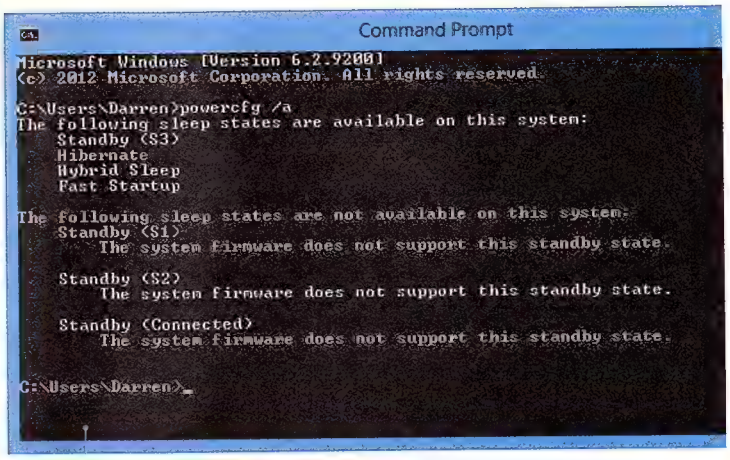
TIP 04 Turn off hibernation

One of tricks used to speed up system load times on older HDD-based computers was hibernation, which allowed you to save your current workspace and boot back up directly into it.

With SSD speeds it's of less value, but still slurps up several gigabytes of SSD space. To turn it off and get that storage back again, click on 'Command Prompt' under 'Accessories', right-click it and select 'Run as administrator'. When the box appears, type `powercfg /h off` and press Enter. To turn it back on, type `powercfg /h on` and press Enter.

DRAWBACKS

Hibernation is a feature more geared for laptops than desktops, where being able to save your work and power down the computer is important for battery life. Losing hibernation won't suit everyone, but if you have a reliable power source, you can make use of various sleep states that exist in modern desktop CPUs. (New sleep states are a big feature in Intel's newly-released Haswell CPU platform.)


Command Prompt
Microsoft Windows [Version 6.2.9200]
(c) 2012 Microsoft Corporation. All rights reserved.
C:\Users\Darren>powercfg /a
The following sleep states are available on this system:
Standby (S3)
Hibernate
Hybrid Sleep
Fast Startup
The following sleep states are not available on this system:
Standby (S1)
The system firmware does not support this standby state.
Standby (S2)
The system firmware does not support this standby state.
Standby (Connected)
The system firmware does not support this standby state.
C:\Users\Darren>

You can check whether hibernation is on with a simple DOS command.

HOW TO CHECK IT

Launch a command prompt, run `cmd.exe` and type `powercfg /a` . This lists all of the available and unavailable sleep states. 'Hibernate' will be listed as one or the other, depending on your last `powercfg /h` command.

TIP 05 Disable scheduled defragging

Everyone knows that defragging an SSD is not only unnecessary, but a downer on SSD life expectancy through a stack of unnecessary writes. However, Windows automatically schedules disk defragging at various points, so on Windows XP or Vista systems, it's a good idea to ensure this is turned off. Why not Windows 7 and 8 systems? Microsoft says it changed the way its defragging function worked starting with Windows 7 and it now automatically detects SSDs.

Instead of defragging, it now 'optimises' SSDs, which really means managing TRIM commands across the drive to reclaim the no-longer-used space (**tinyurl.com/metdkuw**). As XP and Vista know nothing of SSDs, they still use the old HDD method that's no good for SSDs.

To turn off scheduled defragging in Vista, go to 'Start > All Programs > Accessories > System Tools > Disk Defragmenter'. When the new window appears, untick the checkbox next to 'Run on a schedule recommended'.

POPULAR TIPS WE WOULDN'T USE

Just because you read a tip or tweak on the web, even if it's on 100 web pages, doesn't always mean it's actually a good one to use. We've found a few that bring out the nervous twitches. Some people swear by them, but we take a more cautious, conservative approach, particularly with tweaks that remove Windows safeguards in the hunt for minor performance gains or to save a few gigabytes of storage.

TIP 01 Turn off the page file system

Page filing is Windows' way of coping on systems with too little memory. If you load up lots of apps that overflow the system RAM, Windows offloads the least-used apps onto the HDD, reclaims the RAM and loads up your app choice. Turning it off will reclaim gigabytes of page file storage Windows sets aside, although if Windows runs out of RAM, it'll simply bork itself. In short, it's a dopey idea. A smarter alternative is to move the page file to a secondary storage drive if you're really worried about a lack of SSD storage. You'll lose speed every time the system has to write the page file to the HDD instead of the SSD, but it's far better than no page file at all. Better still, load up your 64-bit system with as much RAM as you can afford and reduce the use of page filing altogether.

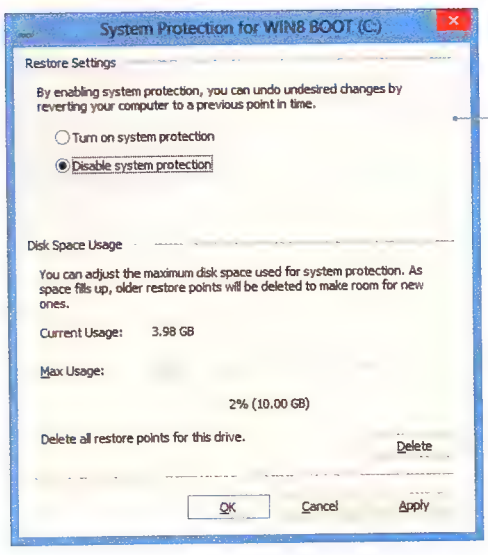
Some may have concerns that the page file system could accelerate SSD wear. However, Steven Sinofsky has some interesting telemetry results from Windows users regarding the use of the page file system in an engineering blog at **tinyurl.com/2u9v8g4**. According to its results:

- Reads to the 'pagefile.sys' file outnumber writes by a huge 40 to 1.
- 67% of read sizes are less than or equal to 4KB, while 88% are less than 16KB.
- Writes to the page file are typically large, with 62% greater than 128KB and 45% equal to 1MB.

Sinofsky goes further to say that he can't think of a better file to have on an SSD than the Windows page file. That's good enough for us.

TIP 02 Turn off System Restore

You'll read mention of this controversial tweak a lot online. Basically, the story goes that System Restore points can cause severe performance degradation by interfering with the way the TRIM command works. Part of the evidence that it's worth turning off is that Intel supposedly recommends doing so for SSD use. However, if you follow the trail, someone always hears this from someone else and that someone else is never Intel. We asked Intel directly, but no-one from Intel Australia responded. Still, there are users who'll swear that this makes a difference, so if you do this, we prefer Corsair's suggested approach: keep System Restore on, but reduce its size to minimum level (**tinyurl.com/pkqnhqn**).

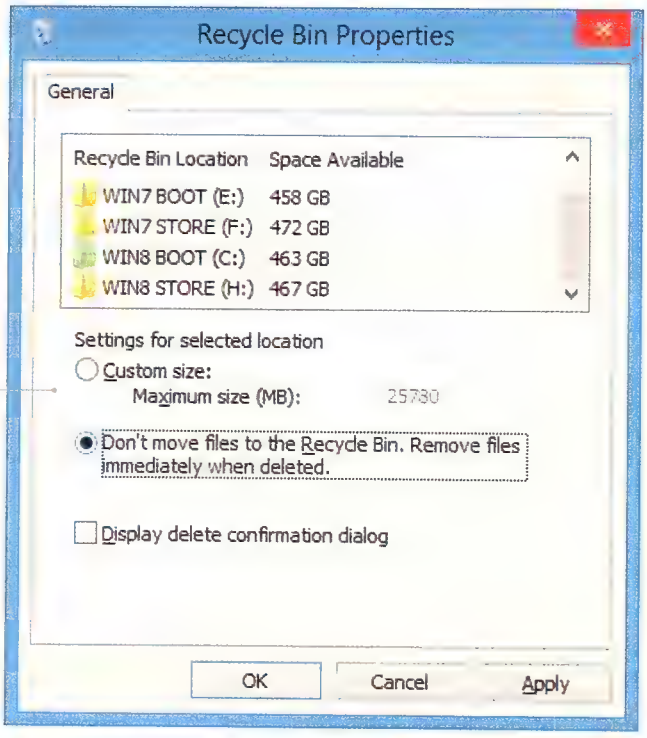

System Protection for WIN8 BOOT (C:)
Restore Settings
By enabling system protection, you can undo undesired changes by reverting your computer to a previous point in time.
Turn on system protection
Disable system protection
Disk Space Usage
You can adjust the maximum disk space used for system protection. As space fills up, older restore points will be deleted to make room for new ones.
Current Usage: 3.98 GB
Max Usage:
2% (10.00 GB)
Delete all restore points for this drive.
Delete
OK
Cancel
Apply

Turning off System Restore isn't a great idea; reducing its storage is better.

TIP 03 Disable the Recycle Bin

This is possibly the worst tweak we've seen. Disabling the Recycle Bin sees you regaining the storage space normally reserved for it, although the cost is any file you delete is unrecoverable.

It's not just because the Recycle Bin is gone, but the TRIM command will automatically and actively reclaim storage blocks Windows says are no longer required. Remember, SSDs have active cleanup that HDDs don't, so if you ditch the Recycle Bin here, those files are not only deleted, the TRIM commands will recycle the storage blocks those files used to live in. That means you can forget about using file recovery software to get those files back, even if they were deleted accidentally. Put it this way – we won't be doing this tweak.



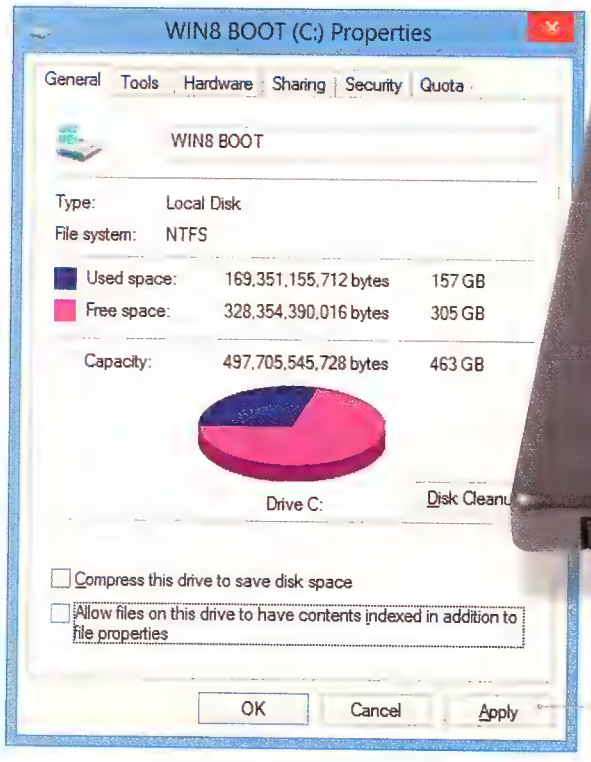
Ditch the Recycle Bin? Not a great idea on an SSD-based system.

TIP 04 Select 'No GUI boot'

This is another popular option that we're not keen on. The GUI boot screen was originally designed to show you what's happening while Windows took its time to boot up. The thinking is that as SSDs are so fast, Windows is simply wasting time loading up its GUI screen if it's only there for a fraction of time. However, the GUI boot also provides useful error messages should your system crash. Without the boot GUI, you don't get those messages. Again, some swear that it saves considerable boot time. Ultimately, it's up to you, but we put this tweak into the 'lose more than you gain' category.

TIP 05 Disable Drive Indexing

This is a popular tweak and even suggested by at least two SSD brands. Drive indexing is Windows' way of helping speed up file searches. However (so the tweak goes), SSDs are so fast, you don't need to index the drive. Indexing also chews up write cycles and contributes to SSD wear and tear. OCZ suggests disabling it (**blog.ocztechnology.com/?p=178**) but only if you're not a big search fan. Corsair does, too (**tinyurl.com/pkqnhqn**), except as more of a 'save CPU cycles' thing, not an 'SSD wear' thing. We've put this one last on the list because it's borderline useful. What's difficult to determine is just how much wear indexing causes on an SSD. Ideally, you want to avoid needless writes to your SSD and in the end, it'll be whether you do lots of file searches that determines if you use this tweak.



Turning off indexing is recommended by some SSD makers.

Corsair is one brand that recommends you drop drive indexing.

FINAL BYTE

You may not agree with our choices and that's fine. However, we'd recommend you at least exercise caution when you're reading web tips, particularly when it comes to SSDs. Much of what you read can be like Chinese whispers. To their credit, Windows 7 and 8 do a very good job of handling SSDs out of the box. Yes, you can tweak them further, but in many tweaks we've seen, you're losing more functionality than you gain in performance.

The most important tweak is to ensure your system is running in AHCI mode, not IDE, and that you're using SATA 6Gbps ports – the physical things that an OS can't do for you. Provided you do that, ensure TRIM support is enabled and scheduled defragging is disabled, there's only one other way to significantly speed up performance – and that's to RAID 0 your SSDs. You can read up on how to do that on page 38.

HOW LONG WILL YOUR SSD LAST?

What endurance do SSDs have and can you know before you buy? Darren Yates explains the specs and what they mean.

SSDs are the go-to solution when it comes to non-volatile storage for PCs and laptops – they use considerably less power than hard drives and offer boatloads more speed. However, they're also slowly killing themselves every time you write data to them. SSDs have a finite number of write and erase cycles, after which reliability becomes questionable. So can you know what endurance an SSD offers before you buy?

NAND FLASH TYPES

The most common indicator of SSD flash endurance is the program/erase (P/E) cycle count. It's the number of times you can program and erase an SSD storage block before it can't be guaranteed to hold your data. Actual real-world longevity is a function of many different features, but it starts with P/E cycles.

SSDs are made from NAND flash memory and one quality measure used to determine price is the P/E cycle rating. Some lower-cost (less than $1 per GB) SSDs can have a P/E cycle count of as low as 500 or 1,000, although typical consumer-grade SSDs today are rated at 3,000 (3K) with higher-grade enthusiast SSDs topping 5K. SSD brand PNY has a simple one-page white paper online at **tinyurl.com/ow59djq** that's worth a quick read. Some SSD brands make their P/E cycle numbers easier to find than others; for example, Kingston sells a HyperX 3K SSD that runs 3K NAND flash. Others, like Samsung, don't like to tell.

The number of P/E cycles isn't just a function of manufacture, it's also determined by the NAND type – whether it uses a single (SLC), multi (MLC) or three-level cell (TLC) structure. LSI Corporation delivered a presentation last year that outlined the correlation between endurance and increased storage density (**tinyurl.com/pj4my4l**) – in short, the more bits you store per cell, the lower the number of P/E cycles it can sustain. Look at LSI's chart and it says TLC NAND is barely good for 1,000 P/E cycles, MLC is good for up to 5K, but SLC can top about 100K.

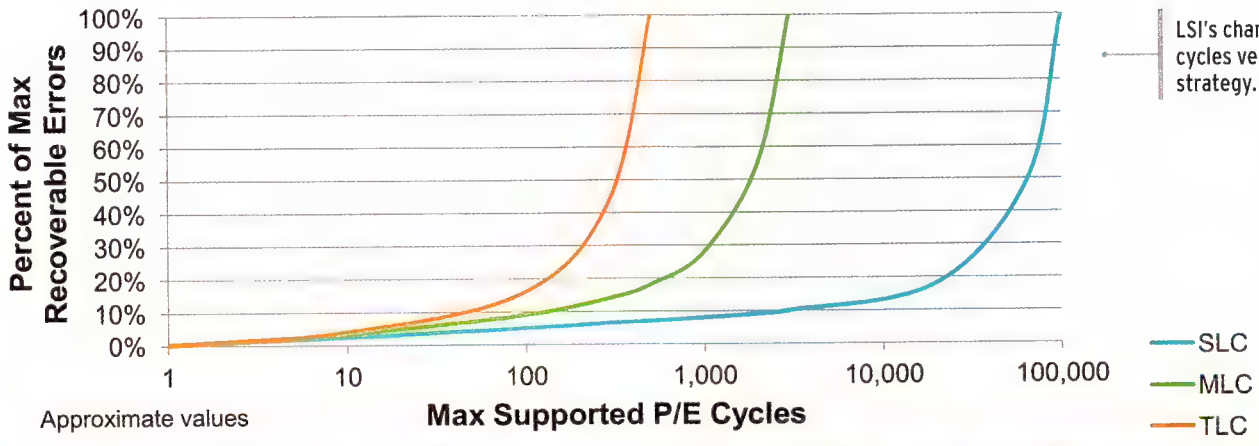
WHAT THE NUMBERS REALLY MEAN

What's important is that thanks to wear levelling firmware, the drive spreads the pain around so that no one storage block cops the brunt of continuous use, and that you get those P/E cycles.

Say you have a 120GB SSD with 3K P/E cycles and you write 24GB of data per day. Write Amplification (WA) is the ratio between data the SSD flash controller has to get through compared to what the drive controller needs to store. The higher this ratio is, the lower your SSD lifespan. Let's assume a poor WA of 10x (2-3x is typical on a desktop), meaning 240GB of data has to be shuffled around to get your 24GB stored. On a 120GB SSD, that works out as an average two P/E cycles per day you're using up. On a 3K SSD, you'd use up those 3K P/E cycles in 1,500 days or just over four years. On a 1K SSD, you'd use that up in 500 days or 15 months.

Remember, these are write figures, not read figures. You'd have to be doing a heap of HD video editing to hit 24GB of data writes per day every day (Intel/Micron say 7GB per day is typical). And since video files are mostly made up of sequential writes, the actual WA would be lower. Halve the WA and you double the lifespan. SSD maker Kingston has more on this at **tinyurl.com/ndkwpuh**. Higher-capacity SSDs will also endure longer wear simply because there are more storage blocks to take the load.

Bottom line, it's not impossible to wear out an SSD – it just takes an awful lot of work.



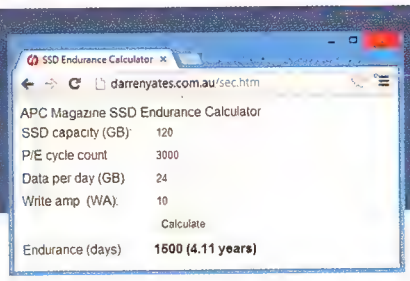
LSI's chart on P/E cycles versus NAND strategy.

LIFESPAN FORMULA

Want to calculate an SSD's lifespan? Here's the formula:

Lifespan (in days) = (drive capacity in GB x PE cycle count) / (data written per day in GB x write amplification factor)

Or you can simply use my SSD Endurance Calculator at darrenyates.com.au/sec.htm.



Calculate SSD lifespan with my SSD Endurance Calculator.

RAID 0 SSDs

Having just one SSD in your desktop is no longer enough. Darren Yates shows how new driver changes can crank your PC through the 1,000MB per second barrier.

Kingston's HyperX 3K is a fast SSD at around $1/GB. A

CHOOSING AN SSD TO RAID

You could devote a book on how to best build RAID 0 SSD setups, but keeping it short, one of the most important factors to maximising your RAID speed is ensuring you pick a fast SSD to begin with. Having Intel RST and two SATA 6Gbps ports for a basic two-drive RAID 0 setup obviously tops the list of must-haves, but choosing the right SSD will help. There are three main factors to look for:

- Fast read and write speeds at low queue depth (QD)
- Low latency (response time)
- Good TRIM response

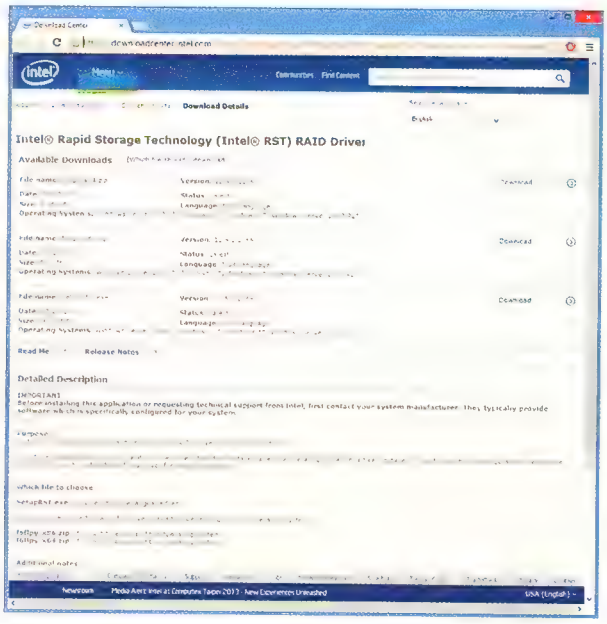
It'll be difficult finding a cost-effective drive that gets absolutely everything right. If you're reading performance scores in online reviews, worry less about high QD read and write speeds, and concentrate on results where the QD level is less than five for a more accurate measure of what you'll likely see (most of the time a QD of 1 or 2 will match what you do on your desktop). QD refers to the number of concurrent calls for data (either read or written) being made to the drive. Latency times are important because you don't want your SSD wasting time figuring out where to find the storage block to read/write. Finally, good TRIM response is important, too. SSD speeds tend to slow over time, but TRIM should return that speed to initial levels. It doesn't always do so, however, depending on the drive you pick.

It's common knowledge these days that SSDs can deliver exceptional data speeds that leave traditional platter-based HDDs for dead. What's less well known is that you can now get storage that's twice as fast as an SSD. Yep, that's double the speed of your SSD. How? Well, in one aspect, it's pretty simple: instead of one SSD, you run two. Thanks to some recent driver updates from Intel, it's now possible to double SSD read and write speeds by running those two SSDs in a RAID 0 setup. We'll show you how this month by taking two 120GB Kingston HyperX 3K SSDs and creating a 240GB super SSD that cracks the 1GB/s read and write speeds mark on a budget quad-core desktop (see image A).

HOW IS IT POSSIBLE?

If you've read a bit about SSDs and you're thinking that you can RAID SSDs without TRIM support, cool your jets. TRIM is one of the most important features in an SSD – it not only ensures the reclamation of storage blocks that have been previously written to and are no longer needed, it also ensures that your drive maintains its maximum speeds (or near enough to it). However, this can be problematic when you start lumping SSDs into RAID. It's not a problem for RAID 1 (mirrored) setups, simply because each disk is still independent – if one SSD dies, it doesn't affect the other. Not so with RAID 0 (striped), where the data integrity of each drive is paramount, otherwise the whole array crashes – it's true whether you're talking about HDDs or SSDs.

With SSDs, you have this added problem of TRIM reclamation. If an SSD errantly decides to reclaim a storage block containing data that's still needed, the array crashes and burns. To solve the problem in the past, the TRIM command has simply been caught by the RAID controller and not passed onto the drives, affecting performance terribly. The good news is that late last year, Intel finally released a Rapid Storage Technology (RST) driver software update that gets TRIM right on a RAID 0 SSD setup (see image B).

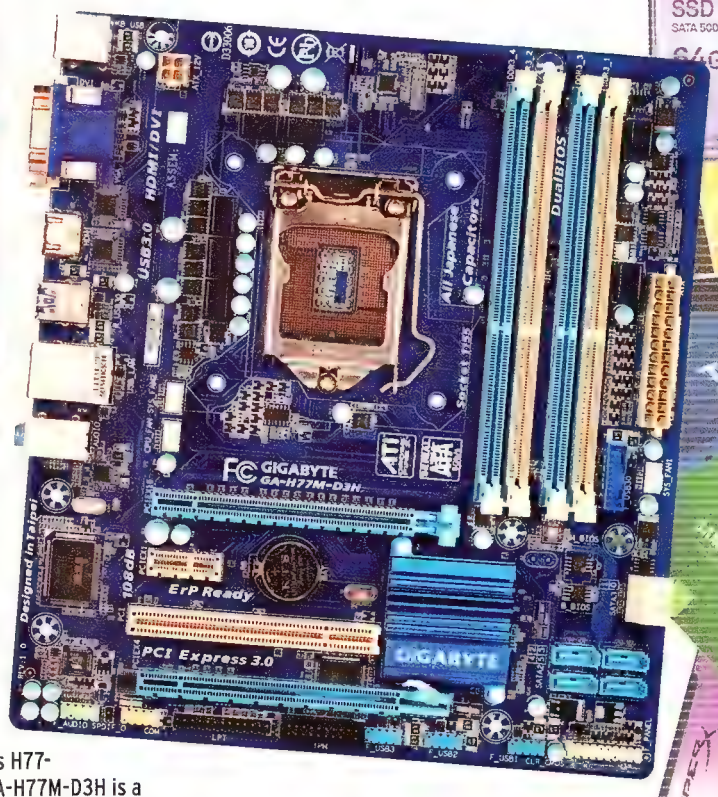


B

Intel's latest RST RAID drivers are a must to get TRIM support.

C

You need to set the SATA mode to RAID in your BIOS.



D

Gigabyte's H77-chipset GA-H77M-D3H is a budget board with RAID support.

WHAT YOU NEED

To build your own SSD RAID 0-based PC, you need two identical SSDs plus a Series 7-chipset motherboard with Intel's RST built in, which means pretty much H77 or Z77 chipset boards. You'll also need Intel's latest RST for RAID driver software (the current version was 12.5 at the time of writing), which you can download from **tinyurl.com/ahws699**), and either Windows 7 or 8.

SETTING UP RAID

Mechanically, setting up SSD RAID 0 is no more difficult than setting up a HDD version. In this case, you'll need a couple of 3.5-inch bay adapters to bolt to your SSDs (usually supplied), a couple of SATA data and power cables, and two SATA 6Gbps ports on your motherboard. Once you've got it installed, that's the hardware done. The rest is setting up the BIOS, installing the OS and drivers, and (optionally) tweaking additional settings.

SETTING UP THE BIOS

We'll assume you're setting up this RAID from scratch – no other drives (for the moment) and no operating system. The first thing you do when you power up is head straight into the BIOS. Here, you need to change the SATA control mode from IDE or AHCI to RAID mode (see image **C**). This activates Intel's RST RAID controller. Once you've made the change, save and reboot, but this time, press Ctrl+I to bring up the separate RAID BIOS. Here, you'll need to create your RAID 0 setup from the two SSDs.

We won't go into the full details here – every motherboard is slightly different so you'll need to consult your manual to get the process for your particular board. The most important steps for creating the RAID are to ensure you select 'RAID 0 (Stripe)' for the RAID mode and set the 'Stripe width' to 128KB or the largest size available. Once you're done, save changes, exit the RAID BIOS and reboot. Just remember, creating a RAID automatically deletes everything that may have existed on those two drives prior, so save any important files first.

INSTALLING YOUR OS

In the bad old days, installing Windows onto a RAID setup was a real pain because you needed to load up the RAID drivers onto a floppy disk and install them early on in the OS installation process, otherwise the install would fail. Thankfully, Windows 7 and 8 both have RAID support baked into the install routine now, so you simply install the OS as normal. When you get to the section on selecting the drive to install your OS onto, you'll see your RAID 0 volume looking lovely as one single volume with the capacity of both SSDs.

Windows 7 and 8 both know about SSDs, so you don't need to worry about turning off defragging. Once the install is completed, you will need to install the Intel INF driver utility and the latest Intel RST drivers to ensure you get RAID TRIM support enabled.

Once you've done that, you're pretty much set. You can choose to perform the tips in the SSD optimisation guide, but hitting 1,000MB/s read/write speeds can happen even if you don't.

OUR TEST BUILD

We put together a test build to prove what's possible. We also deliberately chose a fairly basic build: 2.8GHz Intel quad-core Core i5-2300 (Sandy Bridge) CPU, Gigabyte GA-H77M-D3H motherboard and 8GB of DDR3-1333 RAM. For SSDs, we used two Kingston HyperX 3K 120GB SSDs – at $125 each, they're quite affordable yet have the performance of the higher-grade HyperX series, just with a lower 3K P/E cycle lifespan.

We carried out a large number of tests with both Windows 7 and 8, looking at the RAID 0 performance, as well as the single-drive performance on each of the SATA mode settings – IDE, AHCI and RAID – to see which offers the best single-drive speed. We settled on ATTO to give us a quick graphical look at performance based on transfer size (see image **D**).

RAID 0: BREAKING 1,000MB/S

The HyperX 3K is rated for 555/510MB/s read/write speeds, respectively. In theory, RAID 0 with 12Gbps combined dual SATA port headroom should give somewhere near double those read/write speeds.

On both Windows 7 and 8, that's almost exactly what we got: 1,063/1,050MB/s read/write on Windows 7 and 1,096/1,045MB/s with Windows 8 using the ATTO disk benchmark utility. Given the moderate level of hardware we've used, they're good results.

What's interesting about the ATTO results is the difference in performance with lower transfer sizes, particularly at 16 and 32KB. Here, Windows 7 wipes the floor with Windows 8, with write speeds that aren't far off double Windows 8 results. Why? To be honest, we're not sure, although it's not surprising to see both OSs struggling below the 128KB mark – that's the size of the 'Strip Size' we used when creating the array to begin with, so it makes sense that performance here would begin hitting the end stops.

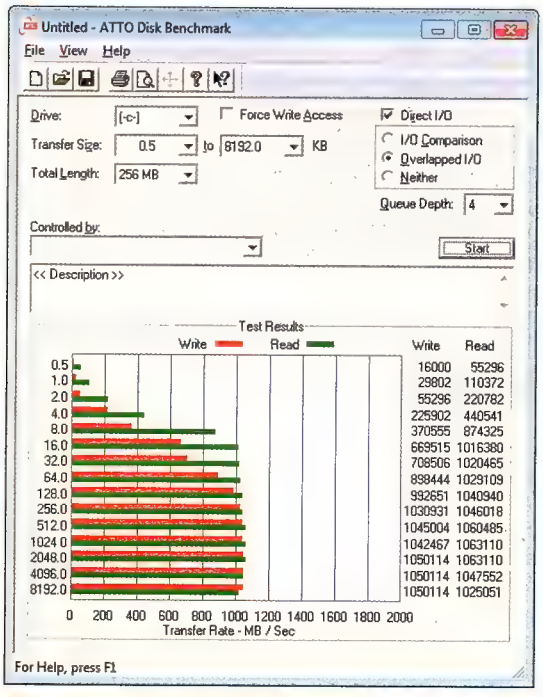
Still, it shows that even with a moderately powered system, it's not difficult to reach these stellar levels of data transfer, thanks to RAID 0 (see images **E** **F**).

SINGLE DRIVE: IDE, AHCI OR RAID?

We also decided to see just how the SATA mode affects single-drive performance. If you've read our SSD optimisation guide, you might remember that setting the SATA mode to AHCI is recommended by most, although MSI notably thought it made no difference. So we decided to test it here, using Windows 8 loaded onto a single HyperX 3K SSD.

Straight away, it was pretty clear that using a HyperX 3K SSD in IDE SATA mode on our Gigabyte board was a waste of time. Write speeds on Windows 8 just managed to top 400MB/s, but read speeds never got past 350MB/s. As soon as we switched to AHCI, those rates jumped to near-manufacturer spec: 526MB/s write and 552MB/s read.

If you read around enough, you'll come across a few sites saying that Intel recommends not AHCI, but RAID mode for SSDs, even if you're just using one drive. Turns out for the most part, they could be right – you can gain around 4MB/s extra speed at the top end and noticeably more 4KB speed with RAID instead of AHCI SATA mode. There are some losses elsewhere, so it might be a case of swings and roundabouts for some of it. We'd need to do significantly more testing to confirm it more broadly, but at least in this case, using RAID mode might be worth a try to squeeze out that extra drop of performance for single-drive SSD builds (see images G H I).



E Windows 7 has no trouble pushing two HyperX 3K SSDs to beyond 1GB/s.

AHCI mode will provide one of the two best options for running a single SSD. G

REAL-WORLD TESTS

ATTO gives us a starting point in terms of raw performance and certainly, two HyperX 3K SSDs in RAID 0 deliver some cracking speeds. However, we'd have to say having that much speed in a Core i5-2300-powered system is a bit like putting a V8 motor on a lawnmower (**tinyurl.com/pwtl6mp**) and that much speed really deserves something approaching an overclocked Core i7-3770K CPU with a Noctua NH-D14 cooler sucking the heat out of it. As it is, our quad-core Sandy Bridge chip can still show us some key real-world tests; namely, Windows boot and shutdown times, and large file/multiple-file data transfer.

WINDOWS EVENT VIEWER

How do you find out exactly how long Windows takes to boot without worrying about a stopwatch? You fire up the Windows Event Viewer, Microsoft's under-the-bonnet diagnostic tool. Event Viewer allows you to look at the system logs recorded by Windows that store all manner of alerts, warnings and messages coming from various functions. And that recording starts as soon as Windows launches its first line of code.

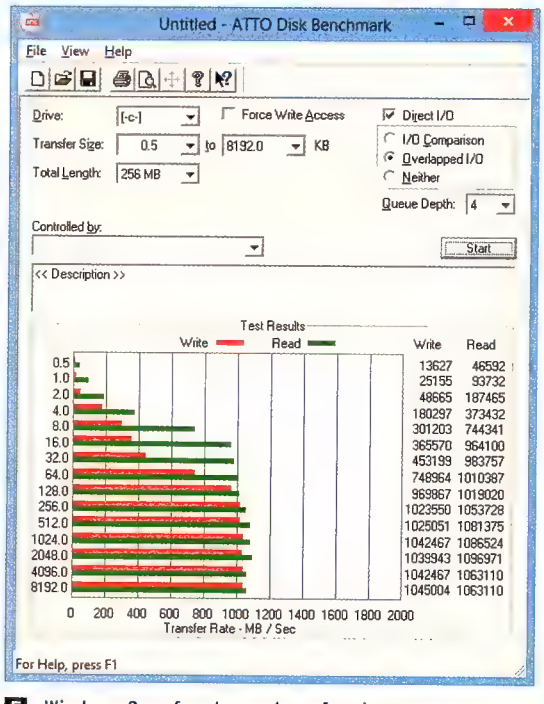
Look into Event Viewer under 'Applications and Services Logs > Microsoft/Windows' and look for 'diagnostics-performance'. Keeping it short, look for event ID numbers 100 (boot) and 200 (shutdown). Click on the 'Details' tab and you'll get a full breakdown of boot and shutdown times. Just beware that the latest log entries will take a few minutes before they appear (see images J K).

RAID 0 BOOT & SHUTDOWN TIMES

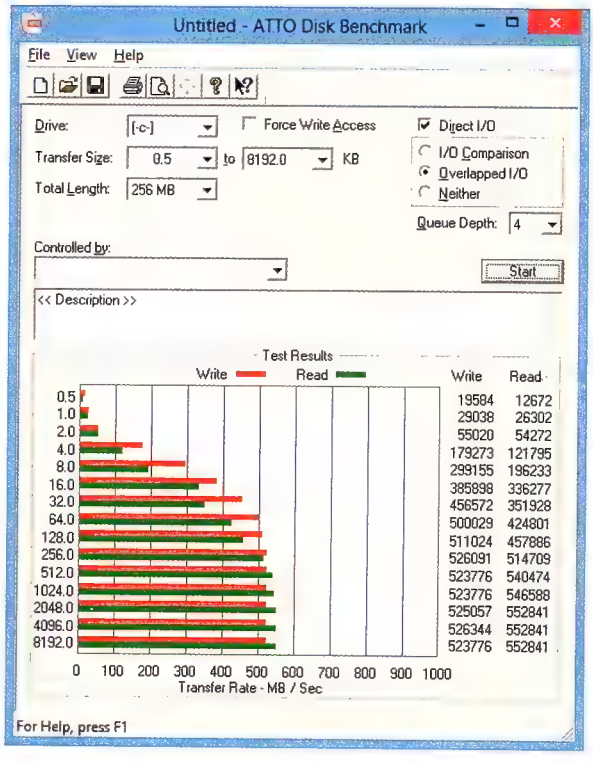
We tested our RAID 0 setup with both Windows 7 and 8 and found some interesting results. Most of us just consider boot time to be the time between turning on the computer and first sighting of the Windows desktop. However, Windows can't start the time clock until the system has passed the POST – the motherboard's Power-On Self-Test. The closest Windows can get you to that generic boot time definition is what it calls the main path boot time: the time from the POST handover until you first spy the desktop. However, that's not the full boot time because while you can use the computer as soon as you see the desktop, Windows continues to load modules in the background, so the actual full Windows-defined boot time is the time from POST handover until all of the modules are loaded.

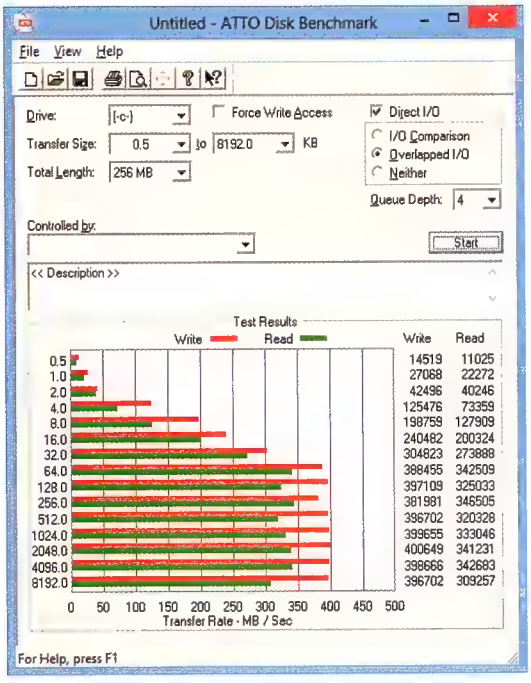
We've recorded both sets of Windows boot numbers, as well as those for shutting down, for both operating systems on our RAID 0 setup. The first interesting result on our test build was consistently finding Windows 7 to have a faster overall boot time than Windows 8 – 14.34 seconds versus 15.54. However, the main path boot time on Windows 8 was nearly a full second faster than Windows 7.

Shutdown time differences were more pronounced, with Windows 8 completing the job in just 1.51 seconds, while

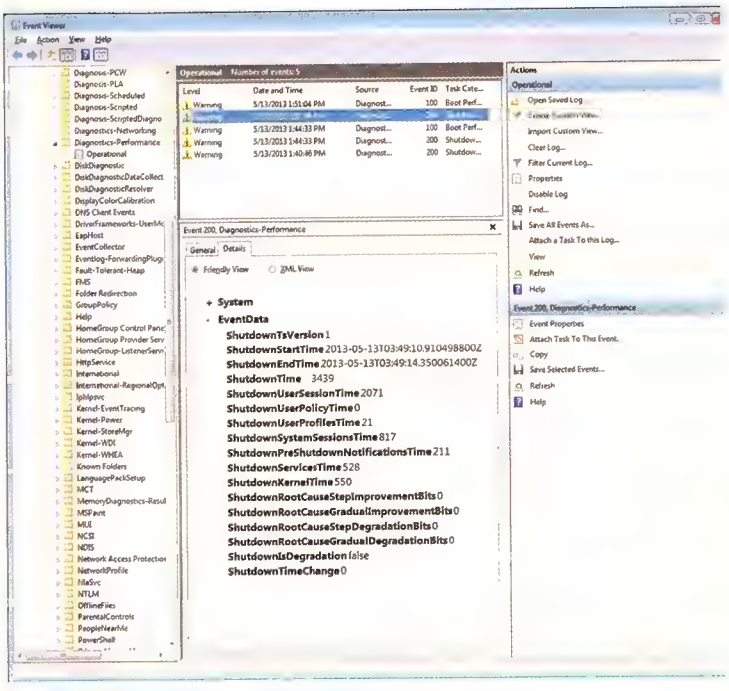


F Windows 8 prefers larger transfer sizes, but still cracks through the 1GB/s barrier.





H Chances are if you run your SSD in IDE mode, you won't get the best performance.



J Windows Event Viewer tells you plenty about Windows boot and shutdown times.

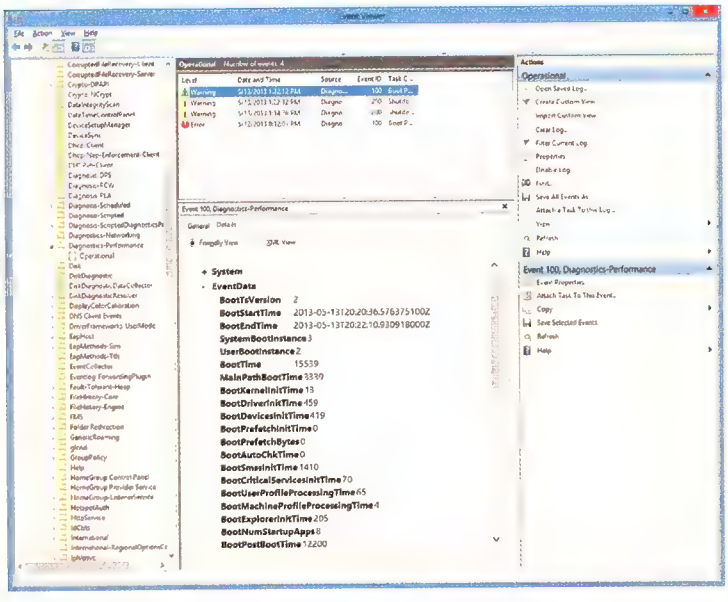
Windows 7 needed a positively sluggish 3.34 seconds. These are raw non-tweaked times, with only the Intel INF and RST driver software installed, but even so, they're decidedly quick (see table below).

SINGLE SSD COMPARISONS

We found a similar overall boot time anomaly using a single HyperX 3K SSD – Windows 7 boots faster overall, but also on the main path boot test – Windows 7 managed 3.74 seconds while Windows 8 took 4.41 seconds. The only difference between the two builds was the OS install: Windows 7 Ultimate SP1 versus Windows 8 Pro (the same driver software was used).

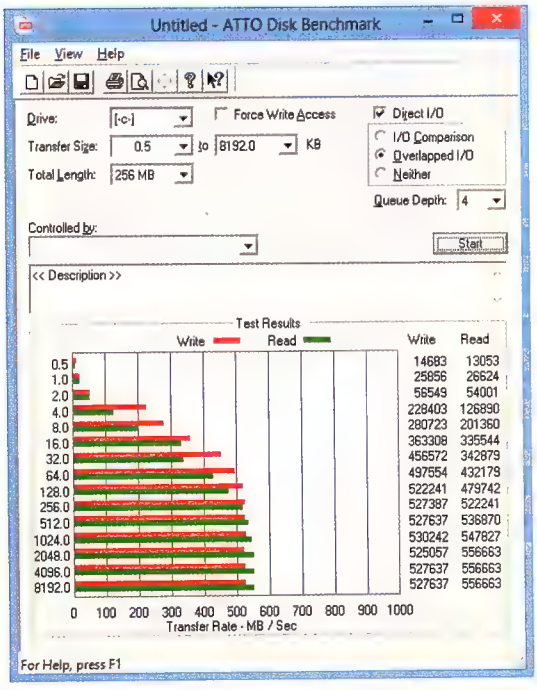
FILE COPY SPEEDS

Normal viewing was restored when we ran the file copy tests, with the RAID 0 systems on Windows 7 and 8 seeing major improvements on the single 4.48GB video file test and reduced gains on massive multiple folder/file testing. Copying a single 4.48GB DVD video file in 19.44 seconds using RAID 0 compared with 35.25 seconds on a single SSD is a major improvement. The gap on Windows 7 was slightly smaller, but no less significant. This is where the rubber really hits the road for RAID 0 SSDs. If you're after the fastest data transfer rates going around, one SSD no longer cuts it.



K Windows 8 also provides the Event Viewer to check your boot times.

I Compare this with AHCI mode and you win in some areas and lose in others.



SSD BOOT & SHUTDOWN TIME TESTING

	Windows 8		Windows 7	
	RAID 0	SINGLE (AHCI)	RAID 0	SINGLE (AHCI)
Overall boot	15.539	16.705	14.165	14.144
Boot to desktop	3.339	4.405	3.965	3.744
Overall shutdown	1.511	1.674	3.336	3.456
Shut down user session	0.418	0.448	1.995	1.847
File copy tests				
Single 4.48GB video file	19.44	35.25	21.06	34.6
2.75GB/12,331 items	18.1	24.85	18.13	23.25

NOTE: All test times are in seconds; lower is better.

SSDs ALL YOU NEED TO KNOW

You've got questions, we've got answers. It's time for Josh Norem's crash course in SSD technology.

SSDs are taking the PC world by storm with their silent operation, blazing speeds and ever-sinking prices, and yet you're hesitant to buy one. Maybe you're afraid of SSDs, or you don't think you know enough to make an educated purchase, or maybe a bad SSD controller took all your data down.

Regardless of the reason for your trepidation, every horsepower junkie should be getting in on the SSD action, and to do that you need a little bit of cash and a whole lot of knowledge. Over the next several pages we'll attempt to answer all of your SSD-related questions. We'll walk you through all the reasons why you need an SSD first, break down the terminology so you can talk like an SSD badass at the next LAN party and then show you the parts of an SSD so you know how it all fits together. We'll wrap it up with a discussion of the software you'll need to monitor and optimise your drive.

While SSDs might seem complicated with their 24nm synchronous MLC Toggle NAND flash and their AHCI-enabled SATA 6Gbps IOPS gobbledygook, you're about to find out they're not as scary as you thought they were.

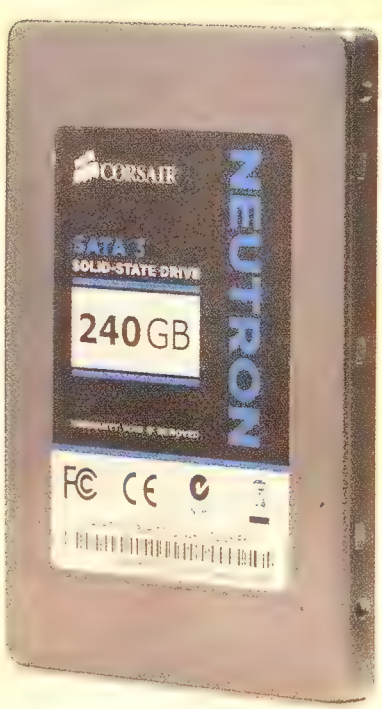
WHAT IS AN SSD & WHY SHOULD YOU CARE?

An SSD has no moving parts. It's basically a thin slice of NAND flash memory that's similar to what you find in a USB thumb drive, although instead of being jammed into a finger-size stick it's stuffed inside a 2.5-inch enclosure with a SATA interface.

SSDs are several orders of magnitude faster than mechanical HDDs for one reason: instead of waiting for the hard drive platters to spin under the read/write heads, you're pulling data from NAND flash memory, so access times are nearly instant. Some SSDs are currently able to completely saturate today's SATA spec, pumping roughly 550MB/s of data through the SATA 6Gbps interface, whereas the fastest 7,200rpm HDD would be lucky to hit 150MB/s across the platter.

Other benefits of SSDs are that they generate no noise since there are no moving parts, which also lets them produce much less heat. They can still get a little warm, but don't require active cooling like an HDD does. And since they have no moving parts, you're free to wedge one into your laptop and toss it around like the bouquet at a wedding, though we don't recommend doing that.

SSDs offer tremendous speed, emit no noise, give off very little heat and fit in the space the size of a few credit cards.



THE EVOLUTION OF SSD FORM FACTORS

When SSDs first burst onto the scene, they came in unwieldy 3.5-inch enclosures the size of HDDs. These SSDs were blazing-fast at the time and prohibitively expensive. We're talking $1,000 for 64GB, although back then it was all that we had, so we paid it. SSDs eventually migrated to the 2.5-inch enclosures that we use now and are also offered in the teeny, tiny mSATA form factor for laptops. If this downsizing trend continues, we expect future SSDs to be microscopic.

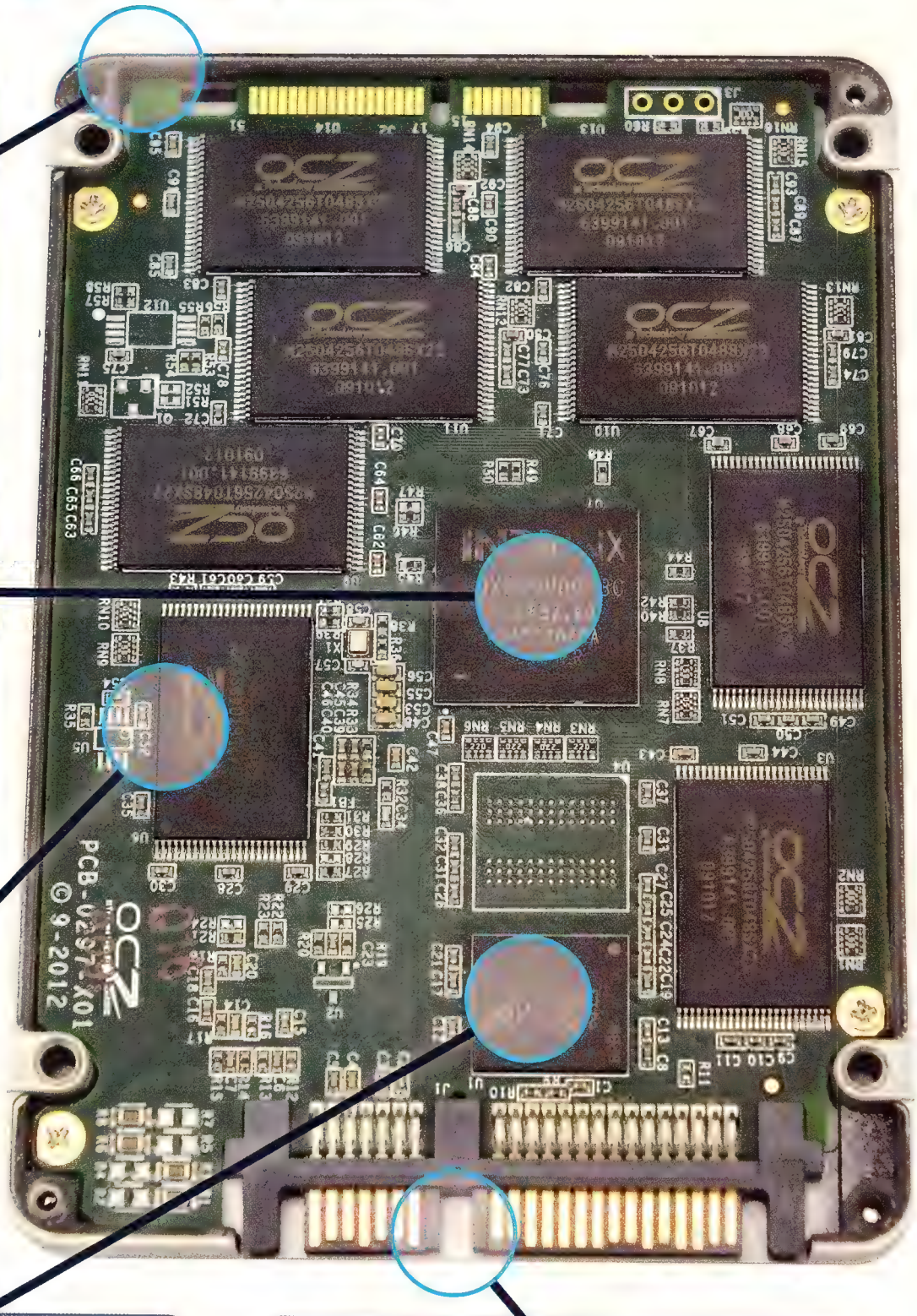
WHAT'S NOT TO LOVE?

Here's the downside: SSDs are expensive, and there's also the chance that whatever drive you select might die on you one day. We know that doesn't sound good, but there are some silver linings here. The first is that prices are dropping rapidly, so much so that right now 128GB drives are hovering around the $120 mark, so that's less than the magical $1-per-gigabyte price bar we've set for an OK deal. Drives with capacities of 256GB are even less expensive, averaging around $220. Sadly, 512GB drives are still a smidge pricey and 1TB drives, well, they don't even really exist for mere mortals. However, SSD prices will continue to fall as adoption rates increase, so any financial barrier to entry you might fear will soon be non-existent.

The second point is much more concerning to you, as nobody enjoys seeing their data go bye-bye. Let's just get this out of the way: many people have had their SSDs fail. We've had our own personal SSDs fail in our home machines and seen units here die an untimely death in our Labs in seemingly random fashion. What needs to be made clear, though, is the fact that in all of these cases it was the controller that gave out, not the NAND flash itself. Anyone who tells you they've reached the end of the life cycle for NAND flash is either high, lying or from the internet, so don't believe them.

It's not the flash that typically dies, but the controllers, and here's the good news: things are improving massively on this front. In fact, we're yet to see a late-model SSD die, and chalk up the earlier failures to the fact that it was simply new technology, not yet battle-tested on the frontlines. The simple truth is that those days are mostly behind us, and as controller and firmware technology has matured, reliability has improved greatly, so we have zero problems recommending any late-model SSD. As always, though, you should back up your data regardless of the storage medium you have in place.

ANATOMY OF AN SSD



OUTER SHELL

This shell could be plastic or metal and helps absorb some of the heat from the flash memory inside. A 7mm shell allows an SSD to be used in an ultrabook, although some employ the thicker 9mm form factor. Unlike with a mechanical HDD, you can remove this cover and run an SSD commando and it wouldn't make much difference to the drive. We don't recommend it, however.

CONTROLLER

The controller runs the show, usually with a multicore processor. This is what separates one SSD from another, for the most part, though custom firmware designed by the drive manufacturer is also a factor. Controllers communicate with NAND over parallel channels, compress and uncompress data, and keep the drive optimised with garbage collection.

NAND FLASH

These are the memory chips that hold your data. They're typically clustered in groups of chips covering both sides of the PCB. Most SSDs you'll see use either MLC or TLC NAND, but if this was an enterprise-level model it might use SLC NAND flash. MLC flash wears down twice as fast as SLC flash and TLC wears down quicker than MLC, but you'll still get many years of usage from MLC or TLC.

DRAM BUFFER

Every SSD also includes a bit of DRAM used for buffering purposes. Like cache on an HDD, data is stored here temporarily before it's written to the device. Wear-levelling data is also placed into the cache while the drive is running. SandForce SSDs are the only models that don't use external DRAM.

POWER & DATA INTERFACE

Modern SSDs ship with SATA 6Gbps interfaces that allow for roughly 550MB/s read and write speeds, although this will change soon since today's drives are saturating the bus. The next-gen interface, called SATA Express, will utilise PCI Express lanes instead, allowing us to eventually hit up to 16Gbps of throughput. Yes, we're salivating.

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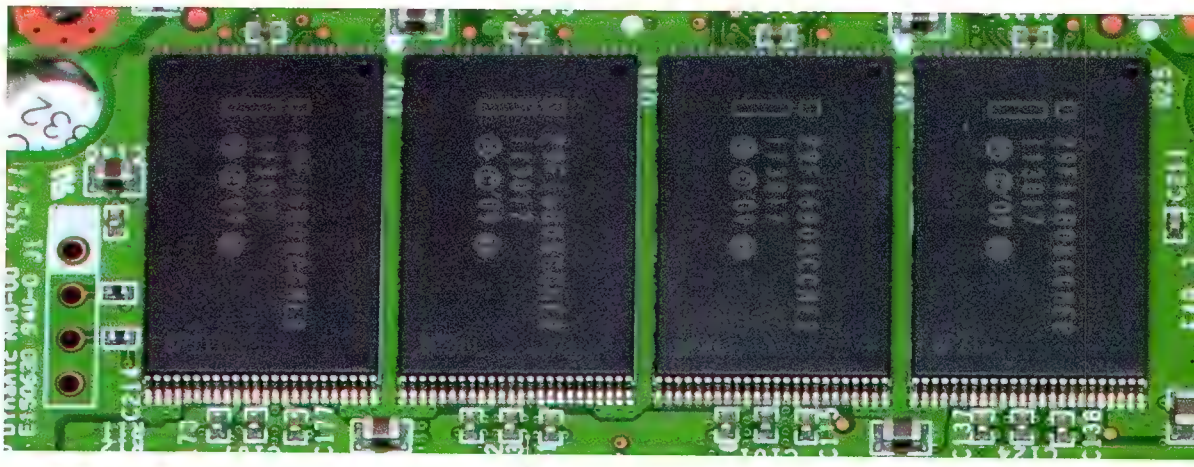
NAND Flash

NAND flash is a type of non-volatile flash memory that stands for 'Not And', which is a reference to the type of logic gate it uses. This is different from NOR flash, which is used in environments where the same program is run over and over again. NAND memory is popular due to its speed, durability and relatively low cost compared to DRAM. It's commonly found in storage devices such as USB keys, tablets, mobiles phones and SSDs, of course. While there are various types of NAND flash, all SSDs on the market currently use this type of memory.



MLC NAND is the most common type of flash NAND.

Controller

This is the brains of the SSD and what truly separates one drive from another, as they mostly use very similar NAND flash. Typical controllers today use multiple cores for running the drive, performing data compression and executing drive optimisations. Before you make any purchasing decisions about an SSD, find out which controller it uses, as some controllers have a chequered history. Currently only Samsung and OCZ have controllers that were designed and manufactured in-house, which theoretically gives them an advantage, while Intel uses SandForce, Corsair uses Link A Media and Crucial uses a Marvell controller.

MLC NAND

This is the most common type of NAND flash used in SSDs today and it stands for 'multi-level cell' memory. Its much more expensive counterpart is SLC or 'single-level cell' memory. In SLC, only one state can be maintained per cell, making it good for one bit of data. In MLC, however, up to four states can be stored per cell, allowing it to hold two bits of data.

The proximity of the two states creates the possibility for more errors, though, which is why SLC is so expensive and rare. Flash memory can only sustain a finite number of read/write operations, but modern day SSDs perform wear levelling in order to allow them to survive for a decade or longer, depending on drive activity levels.

SLC NAND

This is the good stuff. SLC NAND is very expensive and is only found in enterprise-level storage products due to its cost. It stores one data state per cell, and since there are no other data states nearby, it's extremely accurate and long-lasting. At press time a 256GB SLC SSD costs upwards of $3,000, so you won't be seeing them in your home machine any time soon.

TRIM

TRIM is something you'll hear about a lot with SSDs because it performs the crucial function of helping the SSD optimise itself when it's idle, so not having TRIM support is bad, and it needs to be in both the drive and your OS.

Essentially, the TRIM command is sent from the OS to the drive's controller to tell it which bits of data can be safely deleted, so without TRIM the drive could theoretically just fill up and degrade. Since NAND cells can't be overwritten, they must be erased before new data is written to them. The command also lets the controller reorganise data, similar to defragmenting an HDD. TRIM is supported in Windows 7 and 8, and in all modern SSDs.

Asynchronous vs. synchronous flash

You'll see this in an SSD's specs and the bottom line is, asynchronous flash isn't as fast or expensive as synchronous flash. It's therefore not uncommon to see it in value drives, while synchronous flash is used in high-performance drives.

Synchronous flash processes data roughly twice as fast as asynchronous on both ends of the clock cycle, so you get two outputs per cycle; asynchronous isn't synced to the clock speed of the processor, so you can expect lower performance.

IOPS

This spec shows how many operations per second the drive is capable of performing. This differs from read/write speeds in that it's not measuring the speed of the writes or reads, but the number of them. This is typically used in situations where heavy random workloads are needed, simply because in our opinion, it sounds better to say 85,000 IOPS than 30MB/s.

Sequential read/write speed

This is how fast a drive can read and write contiguous data, sort of like an elephant inhaling a row of peanuts. This is often used as a metric for benchmarks because it measures 'straight-line speeds', although it's not indicative of real-world performance as data is rarely written or read in this fashion.

Secure Erase

Old blocks of data on an SSD have to be erased before new blocks can be written to it, which takes time, so the fastest an SSD will ever be is the moment it comes out of the box and is totally empty. Unfortunately, even if you deleted everything on the drive, the data is still there, so it will still need to be erased if you want to write over it (TRIM does this to some extent, but not completely).

The only way it's possible to totally wipe a drive of all its contents is via what's known as a Secure Erase, which completely deletes all the data on a drive. This is the most common way to get an SSD back to its fastest possible state and is accomplished using software included with your drive.

THE DOWNSIDE OF USING TRIM

The TRIM command has been made into something of a living legend in Windows 7 and 8 because it's so crucial to keeping an SSD optimised via garbage collection and the deletion of data that's no longer needed. Since SSDs require a data block to be erased before it can be written to, it's important to have that deletion occur before the data needs to be written, otherwise the whole process gets bogged down with multiple operations instead of just a simple write command.

There's a big downside to keeping your drive optimised, though, which HDD users are lucky enough to not have to contend with: if you accidentally delete a file and then try to undelete it via recovery software, you may be out of luck. That's because TRIM, or even the drive's own firmware, may have already deleted the data forever. More disturbing is that TRIM can be executed at any time – its schedule isn't transparent to the user – so 10 minutes after you've deleted the file, it might already have been purged.

If you're a serial file-bungler and find yourself in constant need of file recovery, consider disabling TRIM to buy you a little more time to recover inadvertently deleted data (at the cost of overall performance). Windows 7 users should also consider leaving system protection on, which will occasionally make copies of files. Windows 8 users should enable the 'File History' feature, which makes real-time backups of files on a secondary drive for you.

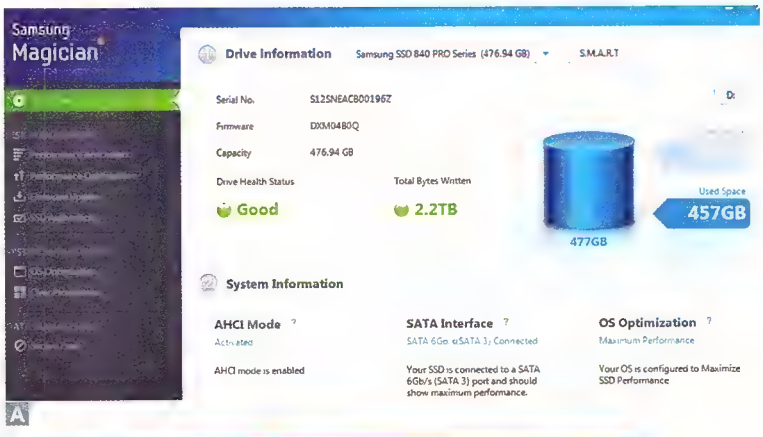
THE SOFTWARE SIDE

SSD utilities can make all the difference to your drive's overall functionality.

While most people install an SSD and never give it a second thought, free software makes it possible to monitor, optimise and tweak a drive's performance. Samsung, Intel and OCZ SSDs come bundled with free utilities and you can use the free CrystalDiskInfo (**tinyurl.com/6x7xc3**) with any SSD on the market. Here's a quick peek at what each one offers.

A Samsung SSD Magician 4.0

It's hard to believe, but not only does Samsung make arguably the best SSDs available right now, it also makes the best SSD software. Right on the home screen you can see how much data has been written to the NAND, its status, your interface speed and more. If your OS doesn't support TRIM, you can click 'Performance optimization' to TRIM the drive manually. You can also update the firmware, adjust over-provisioning space and so on. Samsung regularly updates its software, too, making the choice to invest in a Samsung SSD that much easier.



B Intel SSD Toolbox

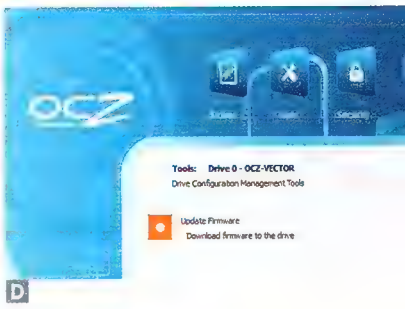
Intel's toolbox software is easy to use, full of information and tells you right on the home screen what the drive's health status is at the moment. Diving deeper into the menus will let you update the drive's firmware, perform a secure erase, run diagnostic scans on the drive, run the TRIM command and it will show you how to fully optimise the drive with your OS. If you're super-nerdy you can also choose to examine the drive's SMART data and details, but the whole point of the simple interface is to show you all that data in an easy-to-digest fashion. Still, it's all there if you really want to see it.

C CrystalDiskInfo

This is a free utility that should be able to read the SMART data from any SSD and give you an indication as to the drive's health, information about its activity and more. One field to pay attention to is 'Total NAND Writes', as that will give you an indication of how much has been written to the drive if you like to keep tabs on those things. It also displays the current firmware version, SATA transfer mode, which features are enabled and all the SMART data.

D OCZ Toolbox

OCZ's free Toolbox software is basically the equivalent of a three-blade Swiss Army knife, in that it only lets you do a few things with your SSD. It's actually strange that OCZ would spend time and money to develop a software tool and then populate it with so few options, but since it's free software we're not complaining too much. The tool gives you the ability to check for firmware updates and apply them, as well as perform a secure erase of the drive. It'll also spit out the drive's SMART data in the most unfriendly manner we've ever seen, so have fun translating it. This utility is helpful for updating your drive's firmware, but not much else.



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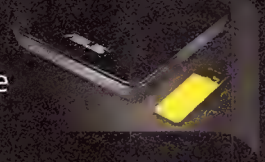

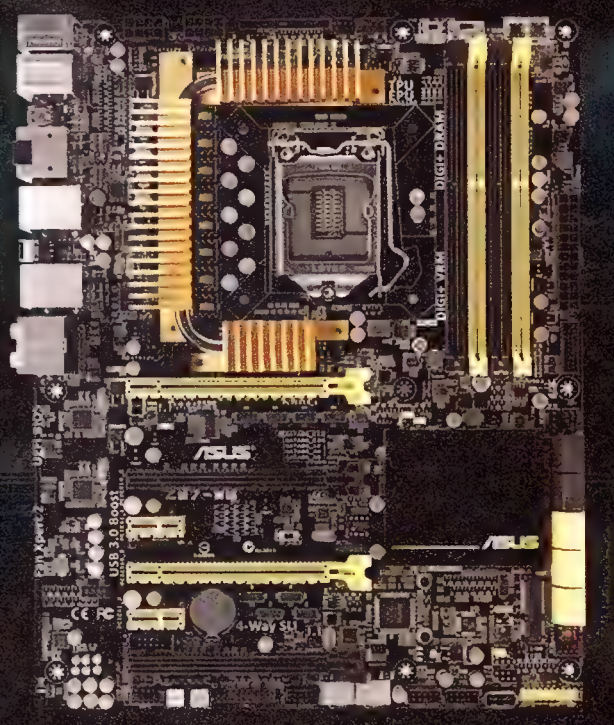

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TOUCH-READY LAPTOPS

Touchscreens are ubiquitous on smartphones and tablets, but many manufacturers are now including them on laptops, too. Lindsay Handmer tests six of the latest Windows 8 models.

Windows 8 is designed to provide a touch-friendly user interface, one that moves away from emulating a mouse and takes advantage of features such as gestures like pinch-to-zoom. Think of using a touchscreen as the modern equivalent of learning keyboard shortcuts; it may take some getting used to, but on a laptop a touchscreen can add an extra layer of interactivity and make navigating Windows 8 very fast. (Not to mention that it'll let you play *Angry Birds* all day and draw rude shapes in Paint.)

Many laptops are now coming out with innovative designs, such as rotating or removable screens that allow for a more touch-friendly and tablet-like experience.

For now, touch control works best on the new Modern UI, although it can be a bit hit and miss in desktop mode. While there are many shortcuts and gestures that still work across both, accurately selecting small elements – like files or menu items – can be tricky on the desktop.

Of course, touch has some major downsides – your screen will get coated in fingerprints (most touchscreen laptops also ship with extra-large cleaning cloths) and it can be awkward to switch between the touchpad and screen. A well-positioned mouse can actually make it easier to swap to and from the touchscreen, as your arm is already extended and next to your laptop. Some screens are also flimsy enough that they move when touched, making it very hard to be accurate.

One of the supposed downsides of a touchscreen laptop is 'gorilla arm', where holding your hand up in front of you gets very tiring (and presumably starts growing hair). In our experience this is a non-issue though. Touchscreen control on Windows 8 is great for occasional use, such as flicking though photos or scrolling around the Modern UI, but it's rarely very long in duration.

Unless you have specific touch-enabled applications in mind, we can't recommend paying too much extra for a touchscreen. However, considering they're now being included on even budget laptops, touchscreens do offer a fresh way to interact with your computer.

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- 1.8GHZ PENTIUM 2117U CPU

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Acer V5 Touch

Is a touchscreen worth it on a budget laptop?

@ www.acer.com.au

✓ Very affordable, optical drive, 15.6-inch screen.

✗ Average battery life, boring style, heavy.

Rather than the usual array of Core i3 and i5 processors, buried inside the V5 Touch is a Pentium 2117U. It's an ultra-low-voltage CPU running at 1.8GHz, with dual cores that are single-threaded. For those who are unfamiliar with this chip, it's similar in performance to the Core i3-3217U, though with a lower price, slightly lower power consumption and fewer features. The V5's also equipped with 4GB of RAM and a standard 5,400rpm 500GB HDD instead of an SSD.

The V5 manages to squeeze in an optical drive and while it's only a DVD drive (not Blu-ray) it's still a very useful inclusion for those who have to regularly deal with optical media. The keyboard is well-spaced, easy to type on and has minimal flex. The trackpad is responsive and has a great tactile feel.

The V5 has an unexcitingly average 2 hours and 49 minutes of battery life, and is actually a pretty heavy laptop at 2.6kg. It's therefore not the ideal choice if you're after always-on-the-go portability. Connectivity is good though, with two USB 2.0 ports, a single USB 3.0 socket, HDMI output, card reader, Wi-Fi and Bluetooth. Via an included adapter you can also easily add a LAN port or VGA output.

The 15.6-inch screen had good viewing angles, but the colours are a little muted. The 1,366 x 768 resolution is lower than we would like, but it's a necessary trade-off to keep the price down. Fortunately, the 10-point multitouch display is excellent and we had no problems navigating our way through Windows 8.

If we had to accuse the Acer of anything bad, we would have to say it's a little boring, albeit in an affordable, practical Toyota Camry kind of way. Shopping online, the Acer can be found for under $600; at that price, it's an excellent buy.

- HDMI & VGA PORT
- 1.85KG
- LARGE TRACKPAD

7/10

$695

ASUS VivoBook S400CA

An affordable ultrabook impersonator.

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✓ Inexpensive, slim, responsive.

✗ Average battery life, no SSD, poor keyboard.

Easily mistaken for a boring run-of-the-mill laptop, the ASUS VivoBook is an affordable option with a range of extra features. For a start, it has a touchscreen, is only 2cm thick, has a large array of ports and a sleek, wedge-shaped chassis. Our test model used a 1.8GHz Core i3-3217U CPU paired with a rather massively-overkill 6GB of RAM. No discrete GPU is included, but the Intel HD 4000 graphics do a passable job and can handle a little casual gaming. It has a standard 320GB HDD, but no optical drive and the 14-inch touchscreen runs at a standard 1,366 x 768.

In use, the ASUS is very responsive and our review unit had no real bloatware installed to slow things down. While the trackpad is large and accurate, the keyboard is a springy mess that's best avoided for long typing sessions. The screen is vibrant and bright, and better yet, it's covered in a glossy panel of glass from edge to edge. This makes using the touchscreen easy, though it picks up fingerprints and smears quickly. Audio quality from the built-in speakers is slightly above average, although it lacks the crispness of more expensive models.

The battery life isn't exactly standout, but we managed 3 hours and 36 minutes in our tests. You also get a webcam, Wi-Fi, Bluetooth, HDMI out, VGA port, LAN connector, three USB ports (though only one USB 3.0), a card reader and a 3.5mm headphone jack. At only 1.85kg it's also very portable.

While the VivoBook uses lower-end hardware, it's at a level where Windows 8 is fast and responsive, without power you don't need going to waste. Thanks to the quality build and slim form, you could easily convince people it's an ultrabook. Amazingly, if you shop around you can pick up the S400CA for under $700, which in our books makes it a great bargain.

- FLIPPING SCREEN
- MINI DISPLAYPORT
- CPU UPGRADE OPTIONS

7/10

$1,599

Dell XPS 12

Get ready to flip out.

@ www.dell.com.au

✓ Slim, powerful, good battery life.

✗ Noisy, screen flicker, no HDMI out.

One area where touchscreen laptops can be a little clumsy is when you want to use the touchscreen exclusively. Windows 8 is actually quite capable sans keyboard, so Dell created an innovative screen mechanism to let you use the touchscreen in a more practical manner. The 12.5-inch screen can actually rotate in its bezel, allowing you to flip the screen over and close the laptop to let you use it like a tablet.

The XPS 12 has a 2.6GHz Core i5-3317U CPU, 8GB of RAM and a fast 128GB SSD. The screen is very bright, with excellent colour reproduction and a Full HD 1,920 x 1,080 resolution. (Oddly, we noticed some minor display flicker when charging, but we believe this is just our review sample.) Graphics is provided by an integrated Intel HD 4000 GPU, which is good enough for low-end gaming. Flipping the screen and using the laptop as a 20mm thick, 1.54kg Windows 8 tablet is surprisingly quick and easy, and a great way to save some space on cramped public transport. The XPS 12 has some high-end extras such as backlit keys, a Gorilla Glass screen, machined aluminium surrounds and a carbon fibre body.

However, connectivity is limited to just two USB 3.0 ports, Wi-Fi, Bluetooth, mini DisplayPort and a 3.5mm audio jack. You do still get a webcam and a pair of relatively weak speakers. The battery life was excellent – we got over 4 hours in our tests. Under load, the fan inside can be a little noisy and has a particularly annoying high-pitched tone.

While the i5 processor here has plenty of oomph for your typical programs, you can get the XPS 12 with a more powerful Core i7 CPU and 256GB SSD if desired. While the Dell packs a lot of punch into a tiny frame, expect to pay a premium. Our test unit retails for $1,599, but prices start at $1,299.

- DISCRETE NVIDIA GEFORCE GT 630M GPU
- ALTEC LANSING AUDIO
- DUAL USB 3.0 PORTS

6/10

$999

HP Pavilion TouchSmart 14-b169tx Sleekbook

Slim and relatively affordable.

@ www.hp.com.au

✓ Good touchscreen, loud audio, Core i5 CPU.

✗ No SSD, not an HD screen, poor battery life.

Housed in a sleek glossy black frame, the TouchSmart is solid and stylish, if a little plasticky. It's just 21mm thick and weighs 1.8kg, making it easy to toss into a bag. Under the bonnet is a 1.8GHz Core i5-3337U processor that's backed up by 4GB of RAM and an Nvidia GeForce GT 630M GPU. To keep costs down it has a standard 1TB HDD instead of an SSD and sports a 14-inch touchscreen running at a resolution of 1,366 x 768. It comes with an HDMI output, along with the usual card reader, LAN port, Wi-Fi, Bluetooth, webcam and 3.5mm headphone socket. It has two USB 3.0 ports and oddly, one USB 2.0 socket.

In use the Sleekbook felt a little laggy, no doubt in part due to an excess of preinstalled bloatware and the lack of an SSD. Fortunately, the touchscreen is excellent and allows you to easily scroll, swipe and tap your way around Windows 8. While it's not exactly a powerhouse, the HP has more than enough grunt for day-to-day tasks and a little light gaming.

The screen is a bit of a letdown, however, with a low, non-HD resolution and mildly muted colours. The keyboard and trackpad are both very usable, but feel somewhat cheap, and the HP doesn't include extras such as key backlighting. The Altec Lansing audio is surprisingly good for a low-end laptop, though, and it's loud enough for watching movies or listening to music. Sadly, the battery life was a bit of a letdown, not quite reaching 2 hours in our usage tests.

While this HP is a little dull compared to some others here, it's actually not too bad when considered in the context of its price. With an RRP of just $999 and an even lower street price, it's an affordable option for a slim, reasonably powerful laptop with a great touchscreen.

6/10

$2,500

- LAPTOP TO TABLET CONVERSION
- DIGITISER PEN
- DUAL BATTERIES

Lenovo ThinkPad Helix

A reimagining of the traditional laptop.

@ www.lenovo.com.au ✔ Powerful, great battery Life, HD screen. ✖ Very expensive, small screen, no keyboard backlight.

The Lenovo ThinkPad Helix is a cutting-edge, ultraportable business laptop with one rather special twist. In an effort to make the touchscreen as usable as possible, the Helix can separate in half and be used as a standalone tablet. It manages this nifty trick by housing all the hardware inside the screen itself.

And don't despair, it has the specs you crave: a Core i7-3667U processor that can run up to 3.1GHz, 8GB of RAM and a 256GB SSD. With an 11.6-inch screen it's aimed at those who are always on the go, yet it still sports a Full HD 1,920 x 1,080 resolution. While it's heavier than most other tablets, it's still only 12mm thick and very easy to hold. The keyboard acts as a dock and it's so secure that you'd never know it's not a normal laptop. Aside from two extra USB ports and a mini DisplayPort output, the bottom dock unit houses an extra battery, too. It also has an oversized soft-touch trackpad, mouse nub and solid (though not backlit) keyboard.

The Core i7 CPU means the Helix is a surprisingly powerful workhorse and will happily handle just about any of your business applications. Battery life is excellent and the ThinkPad lasted 4 hours in our tests, with the second battery almost doubling this. At 1.68kg with the keyboard, it's quite a dense unit, though the tablet only weighs 854g when detached from the keyboard. While you can interact with the Helix touchscreen with your fingers, it also comes with a digitiser pen. This lets you point, select and navigate directly on the screen, as well as draw and write as if it were a graphics tablet.

While it's powerful, flexible and well built, the ThinkPad Helix is a very expensive option – the street price is around $2,500.

6/10

$1,499

- HDMI & VGA OUTPUTS
- DUAL USB 3.0 PORTS
- SONY MEMORY STICK SLOT

Sony VAIO T Series 14

Is this one high end enough where it counts?

@ www.sony.com.au ✔ Powerful CPU, DVD drive, SSD. ✖ No discrete GPU, no Blu-ray, noisy.

Instead of the usual middle-of-the-road laptop offerings, Sony has opted for a high-end Core i7-powered machine. It's got a 14-inch touchscreen, a Core i7-3537U processor that can boost up to 3.1GHz, 4GB of RAM, a 24GB SSD as well as a 500GB HDD for extra storage. It's a little let down by the Intel HD 4000 graphics, which while fine for everyday use, are far inferior to a discrete GPU for both GPU-accelerated programs and gaming.

The 1,366 x 768 resolution is also a bit disappointing for a premium laptop – Full HD 1080p is about the minimum we'd expect. While the screen's viewing angles and brightness are good, the colours lack the pop you'd normally get from a higher-priced laptop. The VAIO does include a DVD drive, but sadly not Blu-ray. It has a good range of connectivity options, with dual USB 3.0 ports (plus a single USB 2.0 one), Wi-Fi, Bluetooth, LAN port, HDMI out, VGA, memory card slot and a 3.5mm headphone jack.

While the style of the VAIO is somewhat blocky, it only weighs 2.1kg and has a quality feel. The keyboard isn't backlit, but it has little flex and is a pleasure to type on. Using the touchscreen was sometimes tricky, as the screen hinge lets it bounce on rough swipes.

Annoyingly, the internal cooling fan spins up and is noisy under even light or no-load conditions. The powerful CPU will drain the battery in around 3 hours if it's working hard, although you'll get over 4 hours of use just surfing the net.

Priced at just under $1,500, the Sony is an OK buy if you need this exact feature set. Otherwise, though, you'd be better off with a cheaper competitor. APC

PANELS ON PARADE

Inexpensive IPS screens, 120Hz refresh technology, ultra-high-res panels — you can have all that and more from the latest PC monitors, says Jeremy Laird.

Affordable PC monitors are miles better today than just a few years ago. As painful as it is to admit, we've mostly got Apple to thank for at least part of that. Yes, really.

In June 2010, Apple rolled out the iPhone 4 and made a huge noise about the new handset's IPS screen. Was it the first smartphone with an IPS screen? Google it if you care because that detail doesn't matter.

The two things that do matter are the fact that IPS is a premium LCD panel technology, which offers improved image quality over the more commonly used TN technology. Second, Apple has massive traction with the public at large and dominates mindshare when it comes to consumer technology.

Suddenly, an IPS screen became something your average Joe wasn't just aware of, but understood to be a good thing. After all, if the iPhone 4 had IPS, you wanted all your screens to be IPS. This effect can't be underestimated.

Just a few years ago, a key monitor manufacturer we spoke with said it wanted to put better panels in its displays, but that customers weren't willing to pay for them.

Now many people are and it's partly thanks to Apple. Of course, that doesn't mean PC monitors have reached a state of perfection. We'd like to see more PVA panels (another type of premium LCD tech) on the market and more choice in terms of resolution, too.

It's not always easy to pick the good from the bad. Specs can be misleading and unfortunately, gimmicks still abound. But we'll come to all that momentarily. In the meantime, suffice it to say you can get more for your money than ever before. Shop on, people.

BenQ

ASUS

BenQ

Speaking of specs

A few key features make all the difference in a monitor.

Here we go again with another roundup of our favourite screens and some things haven't changed since our last outing. That includes the general value proposition of a good PC monitor. It's the best long-term investment you can make.

That's because a good monitor today will still be a good one for you two years down the road. While a graphics card with a few seasons under its belt can leave you gasping for a few extra frames when you fire up the latest shader-soaked gaming spectacular, your monitor isn't going to affect your frame rates or any other performance variables, for that matter.

For starters, screen technology develops at a slightly more leisurely pace. More than that, it's not performance-critical in the same way that a graphics card, processor or solid-state drive is to a system. But it most certainly is critical in terms of how much enjoyment you'll get out of your PC. It's quite simply and literally your window into the computing experience, so why skimp on it?

Often, it doesn't matter whether you're rocking a worn-out Celeron CPU or some crazy new six-core monstrosity. That web page will look just the same. Not so for a monitor. Whatever you're looking at, the monitor is making a difference.

PANEL TECH

With that little pep talk out of the way, let's consider the current state of play in the PC monitor market. The biggest trend right now is the aforementioned renaissance in panel technology.

IPS (In-Plane Switching) is nothing new, of course, but for a while it looked like it would disappear for good from PC screens. Apple's big push with IPS in the iPhone and iPad changed all that. Now IPS is *de rigueur* for phones and tablets.

Affordable IPS PC monitors then followed around a year ago and prices have been

Mobile Apple gadgets like the iPhone 4 have popularised IPS panel technology.

The next big thing in monitors

This year's CES show in Las Vegas gave us a whiff of what's to come in screen technology.

Resolutions have been stagnant for a while, so it's interesting to note Sharp and ViewSonic showing off some new 4K 32-inch monitors. The 4K standard has a few variations, but for PC monitors, you're usually talking 3,840 x 2,160 pixels – a big jump up from 2,560 x 1,600, which is where mainstream PC monitors currently top out.

These displays require a pair of dual-link DVI or DisplayPort connections and, of course, one hell of a graphics card to pump a grand total of more than 8 million pixels, or double the number achieved by 2,560 x 1,600 efforts.

Not that the new Sharp and ViewSonic screens are exactly affordable, with prices equalling that of a car (around $30K), but with smartphones and tablets increasingly pushing the boundaries in terms of pixel densities, it's only a matter of time before PC monitors get in on the fun. More realistic is the quest for more high refresh rate monitor options this year. Refresh rates of 120Hz and 144Hz are widely available for 22- to 24-inch TN monitors. What you can't get from the big brands are 27-inch, IPS or both with refresh rates this high. Here's hoping that changes by 2014.

What about OLED technology in PC screens? Unfortunately, it still remains tantalisingly out of reach. Several companies are showing off big-ticket OLED TVs, but OLED monitors remain relegated to professional applications, with pricing to match. The upside is that you can buy a conventional LCD monitor today, safe in the knowledge that it won't be made to suddenly look old hat next week when all your friends buy shiny new OLED panels.

ViewSonic's getting into 4K with the VP3280-LED. But it will cost as much as a car.

slowly edging down ever since. We're now at the point where it's possible to snag a 22-inch IPS panel for under $150. It's insane. Some manufacturers offer alternative VA (Vertical Alignment) panel technology for similar prices. It's worth bearing in mind that merely being IPS or VA isn't a guarantee of great image quality. For starters, all of these cheap IPS screens are 6-bit per channel in terms of colour fidelity, so they're not as accurate as premium 8-bit per channel IPS screens of old.

MAKING RESOLUTIONS

Panel type aside, what else should you worry about? When it comes to resolution, unfortunately there's not always a lot of choice. Nearly all panels in the 22- to 24-inch space are 1080p. That means 1,920 x 1,080 pixels. That's hardly a pittance, but when you consider that the latest high-end smartphones can match that and some tablets now outstrip it with 2,560 x 1,600 grids, it's hard to avoid the conclusion that PC monitors are lagging behind a little. With any luck, it'll be IPS all over again, with high-resolution smartphones and tablets encouraging similar technology adoption in PC monitors.

That said, there's a clear downside to higher resolutions in gaming PCs: the more pixels you're pumping, the greater the load on your graphics card. Moreover, there's arguably not a huge benefit in terms of image quality in games in going beyond 1080p with a 22-, 23- or 24-inch monitor. If you want to have more pixels, though, there are options. For instance, Dell still does the 24-inch UltraSharp U2412M and U2413, which both offer old school 1,920 x 1,200 grids. The extra 120 vertical pixels give you that little bit of additional elbow room for web browsing. The cheaper U2412M can be had for $399.

The next step up is a 27-inch panel with a 2,560 x 1,440 grid. Prices start around the $625 mark from online retailers and currently, models are all premium panel technology of some kind – you don't need to worry about choosing between IPS and TN. Then there's the old school 30-inch option with a 2,560 x 1,600 grid. Prices for those typically start at around $1,500.

LOOK EAST

It's at this stage that the subject of Korean-sourced 27-inch IPS monitors pops up. There are suppliers on eBay that will sell you a 2,560 x 1,440 27-inch panel for as little as $380, including shipping costs.

The drill here is obviously *caveat emptor*. You're getting a screen with a very cheap chassis and stand, and the panels are those that have been rejected by the major manufacturers. However, lots of people have had great success buying these bargain panels and the prices make them very tempting indeed.

A compromise is to go for a 27-inch IPS or VA monitor that has a conventional 1080p pixel grid. It's a pretty nice overall solution for work and games, and one you can have with the peace of mind of a supplier and brand name you're familiar with. It's also worth noting that the latest TN panels are better than ever in terms of colour and contrast, and even viewing angles. There's no longer any real shame in TN.

Another trend that overlaps with cheap Korean panels is higher refresh rates – 120Hz or even 144Hz. Panels with high refresh rate support (standard LCD screens refresh at 60Hz) began popping up when Nvidia rolled out its 3D Vision technology.

We've never been big fans of the 3D tech itself, but the higher refresh required for an active-shutter 3D solution like 3D Vision comes with its own benefits – at least in the eyes of some, as our 'Does refresh rate matter?' piece in the May issue (page 12) demonstrated. In games, it makes for much more responsive action. Even just juggling windows and scrolling web pages on the desktop can seem smoother. The only snag is that you currently can't have your 120Hz/144Hz cake and eat your IPS panel – it's one or the other, again with the possible exception of those Korean 27-inch panels, some of which claim to have been modded to support a high refresh rate. This is something we've never tested and we'd recommend proceeding with caution.

As for other technologies, like dynamic contrast and fancy colour modes, we're yet to see much benefit. There's simply no substitute for a good panel.

The Dell 3007WFP is seven years old, but its 2,560 x 1,600 panel is still a wonderful thing.

7/10

$330

ASUS VS278Q

So-so specs and performance.

@ www.asus.com.au

✓ 1ms pixel response rate.

✗ Flimsy and limited adjustment stand, no DVI connectivity.

What if you woke up one day to find you'd been transmogrified, Kafka style, into a PC monitor? How to go about leading a fulfilling life? If you boil it right down, you've really only got two options available. Either you wow the world with outstanding features, preferably something that's desirable yet rare – like, say, combining IPS and 120Hz/144Hz technology. Or you could take a stab at being very good at doing something more mainstream.

The ASUS VS278Q definitely falls into the latter category of being a conventional-but-quality product. It's a 27-inch model with a 1,920 x 1,080 pixel grid. It's also a TN panel.

It doesn't exactly leap off the specification sheet. Whether it's the 170° horizontal/160° vertical claimed viewing angles or the 300cd/m² brightness, we've seen its like before.

We readily admit that a pixel response rating of 1ms qualifies the VS278Q as cutting-edge, but the bottom line is that your new life as an ASUS screen will be all about execution. Unfortunately, you could do better. The real-world viewing angles are mediocre, for instance. We found that there was noticeable colour compression in evidence and worse, some nasty pixel dithering when rendering certain colours. Yuck.

Then there's the limited adjustment and physical flimsiness of the tilt-only stand along with the lack of DVI connectivity; however, you do get a pair of HDMI ports and DisplayPort.

9/10

$300

BenQ GW2750HM

Give it time to grow on you.

@ www.benq.com.au

✓ Low price, good contrast VA panel.

✗ Tilt-only stand, weak construction.

The downside of this IPS screen technology development is, of course, that Joe 12-pack's salivating worship of all things Apple doesn't leave room for a more nuanced view.

In that context, what's the point of offering an alternative premium panel technology? There are good technical reasons for doing so and that's exactly the tack BenQ is taking with the GW2750HM. It's got a VA (Vertical Alignment) type panel.

Believe it or not, VA technology has some advantages over IPS. The most obvious is contrast. The best VA panels sport unbeatable contrast and black levels. They're better than TN in most regards and close to IPS for colour accuracy. Factor in a remarkably low list price for a premium-panelled 27-inch model – albeit a mere 1080p Full HD model rather than a 2, 560 x 1,440-pixel monster – and the BenQ becomes a very interesting overall package.

Fire up the monitor and you might wonder what all the fuss is about. The colours don't exactly pop, the LED backlight doesn't exactly melt your retinas and the pixel response isn't TN calibre. Give the screen a little longer, though, and you'll begin to pick out those deeper blacks and the superior contrast. You'll also come to appreciate the wonderfully subtle and detailed colours.

Such nuances, not to mention the low price, make it easier for us to forgive the tilt-only stand and its less-than-sturdy construction. We likey.

wansview

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* NCH530W

DON'T BECOME A VICTIM! SECURITY IS AS EASY AS 1, 2, 3 WITH THE WANSVIEW IP CAMERA RANGE

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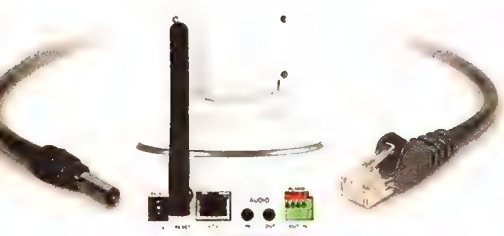

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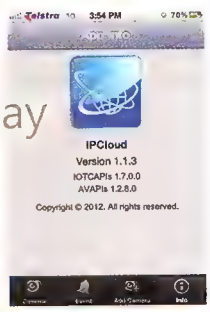

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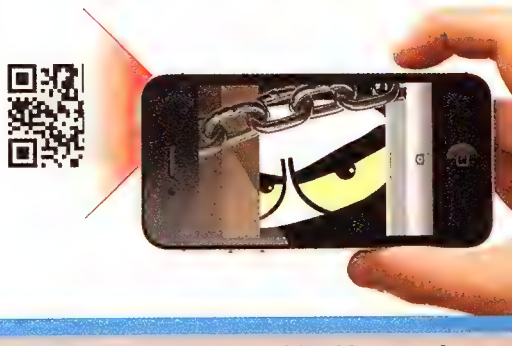

The Wansview NCH530W is easy to setup and use for even the most novice of users. Beyond the plug and play simplicity are a wealth of features for more advanced users such as pan+tilt, wireless network, infra-red night vision, motion sensing, 2-way audio, network recording and much, much more.

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BenQ XL2420TX

A fine 3D solution, if that's what you're after.

@ www.benq.com.au

✓ LightBoost, no evidence of compression, OSD controls.

✗ Bundled peripherals are model-specific.

Admittedly, we have mixed feelings about current 3D technology, although the 24-inch, 1080p XL2420TX from BenQ shows current 3D at its best. In no small part that's due to its full support of Nvidia's 3D Vision 2 technology, including LightBoost. The latter feature significantly boosts a 3D screen's visual punch and vibrancy, which has traditionally been a weak point in monitors that rely upon polarised active-shutter 3D glasses.

However, the basic image quality is also exceptional for a TN panel. There are rich and vivid colours as well as strong contrast, and there's little to no evidence of compression – it's not often you can say that of a TN panel. Sure, the vertical viewing angles here are never going to scare an IPS screen, but this display is very competitive by most other metrics.

What's more, the monitor's OSD controls are a joy to use and the 3D support means a 120Hz refresh rate is on offer.

And so we come to the XL2420TX's $599 street price. That's about $200 more than BenQ's own XL2420T, which is the same panel in every respect apart from the built-in infra-red emitter and bundled 3D shutter glasses. The problem is that you can't use these with any other monitor, which means you're locking yourself in. And at the end of the day, we'd rather opt for the XL2420T monitor and buy our own 3D setup, thanks.

Samsung Series 9 S27B970D

You must pay to play.

@ www.samsung.com/au

✓ Smooth antiglare coating, height and tilt adjustability, MHL.

✗ Very expensive, Crystal Clear Glass panel.

Back in 2005 when the first 30-inch panels with 2,560 x 1,600-pixel grids popped up, we thought it was only a matter of time before big screens with resolutions to match trickled down to the mainstream audiences. Well, here we are nearly eight years later and this 27-inch Samsung screen with slightly fewer pixels (2,560 x 1,440) is still a $1,000 plus item. It's disappointing, but let's put pricing to one side for a moment.

One thing's for sure: It's a gorgeous panel. Samsung pitches it as PLS (Plane-to-Line Switching) technology, although it's basically a derivation of IPS. Except it might actually be better. Samsung's version offers all the usual IPS refinements, such as epic viewing angles and fantastic colours, but you get some extras, too. PLS has deeper, inkier blacks than we're used to from IPS panels. As good as the best PVA screens? Not quite, but still excellent. Samsung also uses a smoother, less sparkly antiglare coating than most conventional IPS panels.

The chassis is a nice piece of work, with height and tilt adjustability and an overall luxury vibe. Samsung has also thrown in an MHL (Mobile High-definition Link) interface, which will enable you to hook up Android smartphones to the monitor.

It's all good, then? Sadly not. For reasons we can't fathom, Samsung has chucked all this behind a so-called Crystal Clear Glass panel. We suppose it's seen Apple do it on iMacs and thought it was a good idea, but it's not. And it comes close to ruining this lovely monitor.

$200

9/10

ViewSonic VX2370SMH-LED

An IPS panel that wows us on all fronts.

@ www.viewsonic.com.au

✓ Full HD pixel grid, LED backlight, stylish looks, amazing price.

✗ OSD controls position, tilt-only base, not VESA-compatible.

Just 18 months ago, monitors like this wouldn't have seemed possible. Not only is its 23-inch expanse endowed with a Full HD pixel grid (that development has actually been run-of-the-mill for a few years), but it's also got an LED backlight.

And here's the really sweet bit: it's an IPS panel to boot. Oh and it's not just any old IPS technology, either. ViewSonic has upgraded it from a 6-bit panel, as with the old VX2336s-LED, to full 8-bit. OK, some pro panels are now 10-bit, but you get all of this for a mere $200, which is ridiculous. That's even before you take into account the fact that it's a sexy-looking little number that also has a stylish chassis.

So, along with all those features it's got a distinctive and pleasingly modern and minimalist look. What more could you ask for?

As for the display's image quality, it's as nice as you would hope from an 8-bit IPS panel, for the most part. However, there's a little colour banding, which for 8-bit tech is odd, to say the least. Unless you're a graphics designer or a publishing professional, though, it's a relatively minor flaw that will go unnoticed by most people. Surely there must be other chinks in the armour?

Actually, yes. The OSD controls give the impression that they've been intentionally positioned to be infuriatingly out of reach. And the base is tilt-only and not VESA-compatible. Still, with the combination of superb screen technology and incredible price, it's an excellent panel.

$209

7/10

ViewSonic VX2460H-LED

An extra inch at the cost of quality.

@ www.viewsonic.com.au

✓ Ultra-slim chassis.

✗ No DVI port, may as well go with the VX2370SMH-LED.

What's an inch worth to you? That's essentially what it all comes down to for the ViewSonic VX2460H-LED. For this is a 24-inch monitor, making it precisely one inch bigger than, yes, a 23-inch monitor.

A blinding glimpse of the very obvious, you cry? Well, we're trying to make a point, which goes something like this: for less than the cost of this 24-incher you can have any number of 23-inch screens, including the aforementioned ViewSonic VX2370SMH-LED. And that's got a lovely IPS panel while this one only has a TN screen. This is where the VX2460H-LED's predicament begins to unfold. Making matters worse, there's no DVI port, just HDMI and VGA ports.

That said, this LCD unit does have a few features going for it. The ultra-slim chassis has quite a natty design, for starters. However, the real value of that is debatable. Unlike a super-skinny HDTV, you're not really going to mount this thing on a wall; that is, unless you live in a cupboard.

As far as TN screens go, we'll concede the image quality is alright, too. Vibrant colours, decent contrast, so-so viewing angles, yada, yada: it's a modern TN panel all around.

You know the drill. Overall, it comes down to that aforementioned inch – 24 is one more than 23. And that makes this screen a little bit bigger. But is it enough to trade IPS in favour of TN? Not so much, in our opinion.

Picking the perfect panel

What to look out for when buying a screen.

Are PC monitors merely badge-engineered commodity items? It's certainly true that only a small handful of manufacturers actually make the LCD panels that go into them, which means there are recognisable levels of technological overlap. Take, for instance, the fact that many of the current crop of affordable IPS screens share panels.

Occasionally, a monitor manufacturer picks up a new panel before the competition. For example, ViewSonic seems to have broken from the fray by upgrading its IPS 23-incher from 6-bit per channel colour to 8-bit. What's more, image processing electronics can make a difference, especially when it comes to colour dithering. So, it's eyeballs out to pore over the details.

We use the trusty Lagom LCD suite of test images and metrics to provide a common baseline. Handily, you can do this as well, simply by heading over to **www.lagom.nl**. There are test images to help you assess everything from viewing angles to pixel response and colour fidelity.

If that's the more objective part of the equation, there's no substitute for some subjective immersion. That'll be games, movies and just flicking about on the desktop. Sometimes a screen that doesn't perform all that well in the objectives is still a very nice panel in practice.

PANEL TYPE

This is the biggie, the heart of your display, and you basically have three choices: TN, IPS and VA. TN is the cheapest and quickest in terms of pixel response. It's also the best for pure gaming. For everyone else, though, IPS is the affordable option and offers superior viewing angles and colours to TN. Pixel response isn't that far behind, either, making it a tough sell for the TN panels. VA is the odd man out. It's used fairly infrequently now, but offers better blacks and contrast than both TN and IPS, along with colour fidelity and viewing angles that sit somewhere in between the two.

BACKLIGHT TECHNOLOGY

We've been waiting eons for a dramatic change in panel technology and yet it never seems to materialise. In the meantime, at least the backlight technology tree has been given a good shake. In the last few years, CCFL (Cold-Cathode Fluorescent) backlights have been almost entirely replaced by LED backlights. Just about every PC monitor is now LED.

But not all LEDs are created equal. For starters, there's the choice between white and RGB LED backlights. The latter produces purer, cleaner light and allows a broader colour space. However, RGB LEDs are expensive and relatively rarely used. None of the screens we tested here, for example, are backlit by RGB LEDs.

IMAGE PROCESSING

Manufacturers know that big numbers make for impressive reading – numbers like 10,000:1 or even 1,000,000:1 when it comes to contrast ratios. Little numbers work, too, like 1ms for pixel response.

These features and more are made possible by image processing technology. Sharp contrast is achieved via backlight modulation, ie. dimming the lights when dark images and video are displayed. Fast pixel response comes courtesy of overdrive algorithms that pump pixels with exaggerated voltages.

The thing is, none of these features are a substitute for a good panel. Strong contrast with a static backlight is always better than the dynamic sort. Overdriving pixels can also lead to side effects like inverse ghosting.

REFRESH RATE

Forget stereoscopic 3D, the next big thing in PC monitors is high refresh rates. At least we think it ought to be. As it happens, the faster 120Hz and 144Hz refresh standard (most LCD monitors feature only 60Hz refresh rates) only came about because it was necessary for active-shutter 3D technology.

But never mind because it's here now and it's lovely. Until you've seen the added smoothness or felt the increased response, it's hard to really appreciate the benefits of a higher refresh rate.

Unfortunately, 120Hz/144Hz technology is currently limited to screens with TN panels. We're still waiting for the ultimate combination of this tech with IPS or VA.

VIDEO INPUTS

Now that we've all gone digital, surely video inputs don't matter? That's true up to a point. Indeed, the video signal used by DVI and HDMI is essentially shared, which is why those little DVI-to-HDMI adapters can be made possible.

But there are a few things worth factoring in. Screens with resolutions beyond 1,920 x 1,200 or with 120Hz plus refresh speed need dual-link DVI or an HDMI 1.4 port on your graphics card to pump all those pixels.

And what about DisplayPort? It offers several theoretical advantages, including the ability to daisy-chain multiple monitors in a serial setup. In reality, though, that's a fairly uncommon usage scenario.

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FUTURE OF THE PC POLL: WHY THE PC IS STILL KING OF SERIOUS COMPUTING
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EDITING 4K-RES VIDEO

Video resolutions are climbing, but what about editing 4K video? Darren Yates puts together a system with a heavy emphasis on speed.

We received a phone call from a former *PC User* reader this month who was interested in a PC upgrade to handle his new GoPro HERO3 camera. The problem? He wants to edit its massive 4K (4,096 x 2,160-pixel) video output. Unfortunately, we didn't get any other details so we'll have to make some assumptions as we go. But one thing is certain: when it comes to editing 4K-resolution video, we're not talking about doing it on an iPad.

GOPRO HERO3

The HERO3 can capture 4K video, but only at a maximum 15fps, so it's not particularly useful unless you're doing time-lapse video. However, with 2.7K (2,704 x 1,524-pixel) video at 30/25fps (NTSC/PAL) rate and even 1440p (1,920 x 1,440 pixels) at up to 48fps, the possibilities become very real. The problem is, without a 4K monitor or TV, seeing the raw video is impossible. Some would even argue whether it's worth bothering with more than standard 1080p (1,920 x 1,080 pixels) anyway. Our golden rule in video editing is you should always work with the camera's highest optical resolution at a workable frame rate. We wouldn't bother with the 4K mode outside of time-lapse. But 2.7K video? Definitely.

ASSISTED ENCODING TECHNOLOGIES

Editing super high-resolution video needs two things: massive, fast storage and even faster CPU speed. But it's not just about raw CPU speed – CPU-assisted technologies such as Nvidia CUDA and Intel Quick Sync can cut video rendering times to fractions of their former selves. However, that extra speed can come at the cost of rendering quality. Further, not all apps support CPU-assisted tech, so it becomes a bit of a minefield building a system until you know which software you'll be using.

To get Quick Sync, you must have an Intel Sandy/Ivy Bridge CPU with integrated graphics. That aside, the two fastest options at the moment are the LGA1155-socketed quad-core, unlocked Core i7-3770K or the LGA2011 six-core unlocked Core i7-3930K. They're soon to be joined by the new Haswell/LGA1150 Core i7-4770K processor.

LGA2011 is a more expensive platform to kit up, although with 4MB of extra cache plus two extra cores, its processing capability is exceptional. If you're talking about video rendering, bring in the Core i7-3770K with Quick Sync and the cheaper option pulls ahead. Adding to the choices is the fact that you can't mix CUDA with Quick Sync, as the latter can't work in conjunction with an external GPU like a graphics card.

So really, before you decide on hardware, you need to nail down which editing software you use and which CPU-assist tech you want to plug into. It's only then that you can make a decision on which hardware platform to choose.

FAST STORAGE

If ever an application was crying out for buckets of fast storage, it's 2.7K video editing and clearly, you want to go with as much SSD as you can afford. The most cost-effective option is an SSD/HDD combo for boot/storage, respectively. But if you're looking at SSDs, do you choose just one for a boot/work drive or do you go two and RAID 0 them? SSD RAID 0 received a boost late last year when Intel released RAID 0 TRIM support for its Series-7 chipsets.

Many people blow off using SSDs in RAID 0 because it halves reliability, given that a failure in one drive sees the whole array crash and burn. But with Windows 7 and 8 having built-in RAID support in their installation routines, it's no more difficult installing Windows on a RAID array than a single hard drive.

If you're thinking of going with an LGA2011/X79 build, things are tougher because the X79 features Rapid Storage Technology enterprise (RSTe), which doesn't officially support TRIM on SSDs in RAID 0. You may have read of unofficial BIOS updates from Gigabyte, ASUS and the like that add it in, but it's a less-than-happy mash-up of both RSTe and RST code. There are also no DOS-mode RST drivers for X79 and the Windows RST console won't work either (see **tinyurl.com/c67fn4s**).

The idea of massive 1.2GB/s sequential read speeds, which would be possible loading in large video files, is tempting. At the very least, we'd consider buying two of the same SSD – you can use them separately, although you'd have the option of RAID 0 down the track.

THE RIGHT CHOICE

While the Core i7-3930K/X79 chipset combo sounds like the best option from a raw horsepower viewpoint, the lack of Quick Sync support plus the greater problem of no TRIM option for RAID 0 SSD setups cruel the deal. We wouldn't choose the first-release Haswell gear either, due to the USB 3.0/S3 Series-8 chipset sleep bug, but if you can wait until September, the new Core i7-4770K and C2-stepping Z87 chipset boards should provide performance close to the i7-3930K/X79 pair.

It's a pity about the X79 chipset because this is an application crying out for the best Intel's got. However, without the right firmware and software support, X79 is likely to cause you more pain than it's worth, particularly if you try to go the RAID 0/SSD route.

In the end, all of that means if you can't wait for Haswell, the best option is to go with a top-drawer LGA1155 Ivy Bridge system. To squeeze out every last ounce of performance, we'd also overclock it, but only with a high-quality heatsink/fan combo.

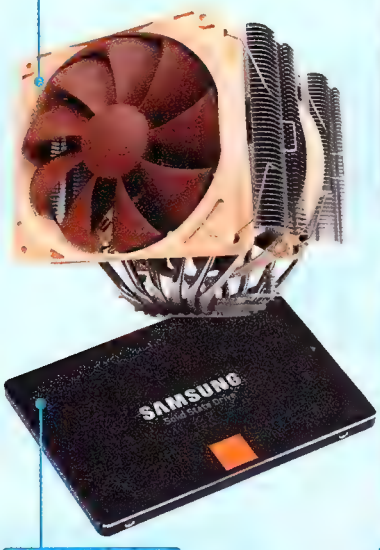
We've come up with two system builds: the one we'd love to have on our desktop plus one that's more affordable.

ASK US!

Looking to make your perfect PC, but not sure what parts to buy? Every month, our PC expert Darren Yates solves a readers' PC building quandary. Email us at contact@apctest.com for your chance to get building!

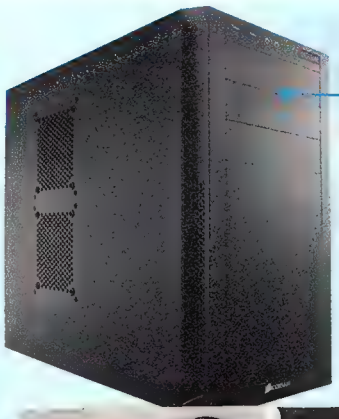
CPU HEATSINK/FAN

The Noctua NH-D14 is the best air cooler going around.



STORAGE

Samsung's 840 Pro SSD is among the fastest on the market.



CASE

We like Corsair's 200R Carbide case for its size and price.

STORAGE

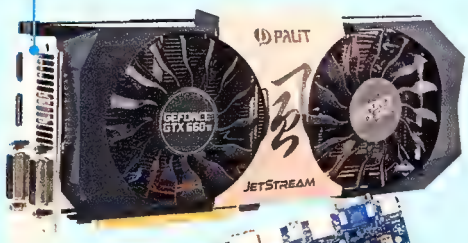
Western Digital WD2002FAEX Black drives deliver performance and reliability.

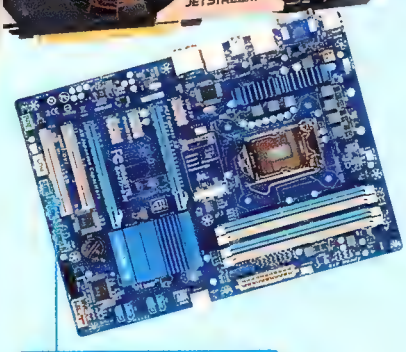
ACTION CAM

GoPro's HERO3 action cam – 2.7K at 30fps is a good reason for lots of fast storage.

GRAPHICS CARD

Nvidia's GeForce GTX 660 Ti packs in 1,344 CUDA cores – Premiere CS6, here we come...





MOTHERBOARD

Gigabyte's GA-Z77-D3H is a compact budget Z77 board, but with enough of what we need.

CPU: INTEL CORE I7-3770K

The fastest LGA1155 chip there is. Get the unlocked 'K' version and overclock it to maximise performance.

CPU HEATSINK/FAN COMBO: NOCTUA NH-D14

If you plan on overclocking your i7-3770K (or i7-4770K) processor, the stock cooler won't be enough. Noctua's NH-D14 is our favourite air cooler for serious overclocking and it's LGA1150-ready.

MOTHERBOARD: GIGABYTE GA-Z77-D3H

Nicely priced at just under $130, this one gives overclocking plus two SATA 6Gbps ports. Hard drives won't push SATA 3Gbps so save those SATA 6Gbps ports for your SSDs. The PCIe 3.0 16x slot will be fine for our chosen GTX 660 Ti graphics card.

RAM: 16GB (2X 8GB) DDR3-1866

To ensure your memory can match it with your CPU in an overclocked environment, we'd go with at least DDR3-1600.

STORAGE: 2X SAMSUNG 840 PRO SSD (RAID 0), 2 X 2TB WESTERN DIGITAL WD2002FAEX BLACK

Samsung's 840 Pro is about the fastest SSD you'll find at the moment at a decent price and flies in a RAID 0 setup. Ensure you use the AHCI/RAID SATA mode setting in your motherboard's BIOS and you should be fine. Two 2TB WD2002FAEX hard drives provide reliable storage.

GRAPHICS CARD: NVIDIA GEFORCE GTX 660 TI

You only need this if you're using Adobe Premiere, although you'll also need to perform the Premiere CUDA hack. Open up 'cuda_supported_cards.txt' from your '\Adobe Premiere CSx\Program Files' folder in Notepad. Add the line GeForce GTX 660 Ti directly under the final entry in the list and save the file (you may need to save elsewhere and copy it over). The GTX 660 Ti is good value, with its whopping 1,344 cores and sub-$300 price tag.

PSU & CASE: ANTEC VP-650P & CORSAIR 200R CARBIDE

Most of Antec's newer PSUs are quality-made by Delta Electronics and the VP-650P only costs $90. Corsair's 200R Carbide case is only $80 and has all the right features.

4K VIDEO PCs

	Build #1	Cost	Build #2	Cost
CPU	Intel Core i7-3770K	$345	Intel Core i7-3770K	$345
CPU cooler	Noctua NH-D14	$85	Noctua NH-D14	$85
Motherboard	Gigabyte GA-Z77-D3H	$129	Gigabyte GA-Z77-D3H	$129
RAM	16GB DDR3-1866 RAM (2 x 8GB kit)	$150	16GB DDR3-1866 RAM (2 x 8GB kit)	$150
Graphics card	Nvidia GeForce GTX 660 Ti	$299	None	$0
Storage – SSD	2 x 256GB Samsung 840 Pro	$498	256GB Samsung 840 Pro	$249
Storage – HDD	2 x 2TB Western Digital WD2002FAEX	$330	2 x 2TB Western Digital WD2002FAEX	$330
Monitor	Dell U2713HM (2,560 x 1,440)	$799	Dell U2412M (1,920 x 1080)	$399
Operating system	Microsoft Windows 8 Pro (64-bit)	$149	Microsoft Windows 8 Pro (64-bit)	$149
Case	Corsair 200R Carbide	$79	Corsair 200R Carbide	$79
PSU	Antec VP-650P	$89	Antec VP-650P	$89
	Total cost	$2,952	**Total cost**	$2,004

Windows 8 Store

AWESOME STREAMING

Nokia Music ramps up the music options for Windows 8 and it's really good!

US$4.99/month | Nokia | tinyurl.com/npllvv8

These days you can listen to online music in an almost unlimited number of ways. There are streaming services such as Pandora that replicate radio when it comes to letting you discover music, then there's the established pay-for-download offerings such as iTunes and all-you-can-eat monthly subscriptions such as Spotify. Except for Xbox Music, though, none of the major music services are available for Windows 8 PC or tablet users. Pandora and Spotify are available for Windows Phone 8, but not for Windows itself, so Nokia has stepped into the gap with its Nokia Music for Windows 8 (**tinyurl.com/npllvv8**), which has been available for a while on Windows Phone 8.

Our reaction at first was 'not another music streaming service'. Somewhat like Pandora, Nokia Music streams music to you for a fee (US$4.99 for every 30 days), although unlike Pandora, the free part only lets you listen to 30 second clips. You also can't listen to individual songs by themselves, but to what it calls 'mixes', which are preselected lists of songs that stream to your computer.

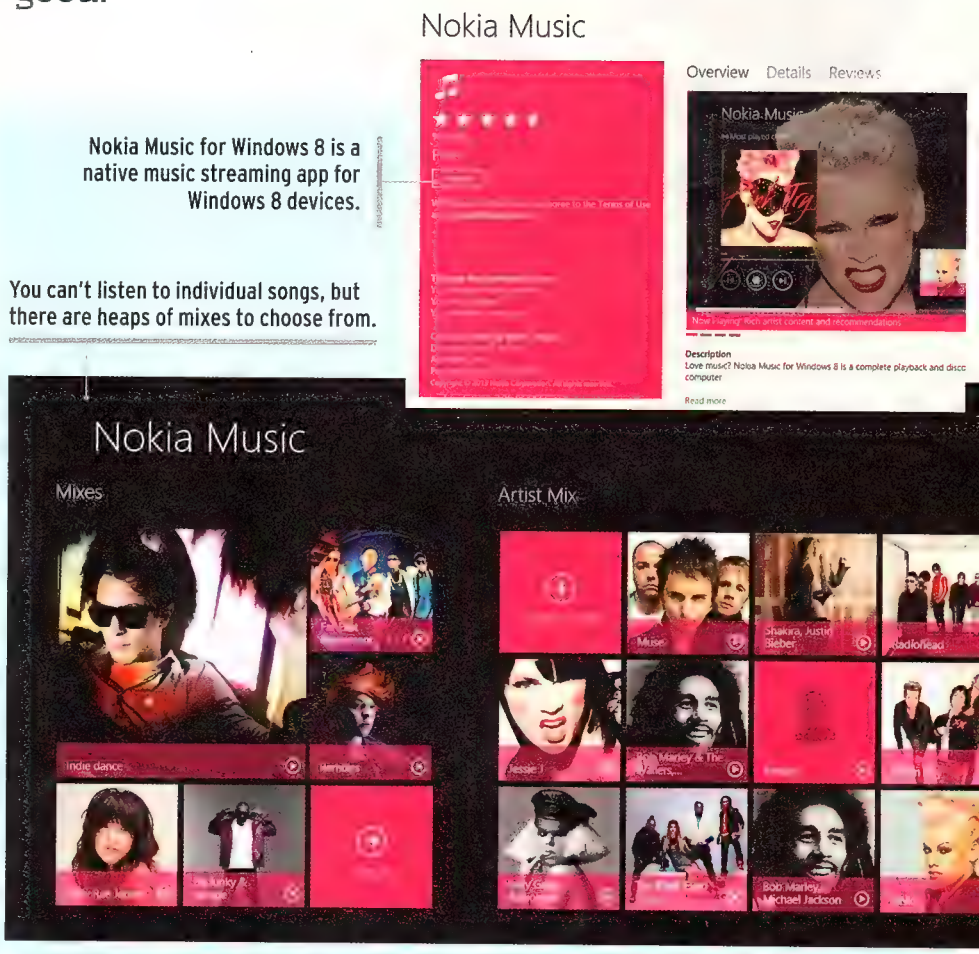
Nonetheless, Nokia Music has two huge things going for it: it's a native app for Windows 8 and it's actually very good.

As a native app it would have to be one of the best designs for the Modern UI that we've seen yet. In fact, it really demonstrates what's possible now that we're moving beyond the initial rush of apps whose user interfaces were banged up quickly to make the Windows 8 launch or come just after it. Its use of artist portraits and album art is stunning, often using them full-screen to underlay the various tiles and options of the app, and pretty much creating a visual and musical feast . Microsoft has been far more successful winning plaudits for its Windows Phone 8 UI than its Modern UI, but you can see where it's going: to a tablet and PC interface that's almost identical to what's on the phones.

Leaving aside the interface, Nokia Music also delivers some good music, which is the whole point of the exercise. You can't select individual songs, but you can make up your own mixes with as little as three artists. Otherwise there are some excellent preset mixes that will stream to your computer. They include top-of-the-charts mixes (such as the UK singles chart and US Billboard hot hits), as well as music category mixes, such as 'Dan's indie' and even 'gym charts'.

Of course, you also want to buy music, so once you like a song in a particular mix, you're able to purchase it from the Nokia Store. When we clicked on a link to buy an Amy Winehouse song, we were taken to the Nokia Music Store. After filling in credit card details, we were offered a download link to an MP3 file, which downloaded to our computer.

Ironically, once you've got the song, it doesn't play in Nokia Music, but in Microsoft's Xbox Music service that comes with Windows 8. It does beg the question, why bother with Nokia Music in the first place, given that Xbox Music also lets you stream and listen to music á la Spotify? The answer here is the same to the question of why you'd run Pandora rather than Xbox Music – it's just a simpler, no-fuss music service that's also perfectly replicated on any Nokia Windows Phone 8 handset.


Nokia Music
Overview Details Reviews
Nokia Music for Windows 8 is a native music streaming app for Windows 8 devices.
You can't listen to individual songs, but there are heaps of mixes to choose from.
Nokia Music
Mixes
Artist Mix

Twist Pilot!

$2.99 | Crash Lab | tinyurl.com/TwistPilot

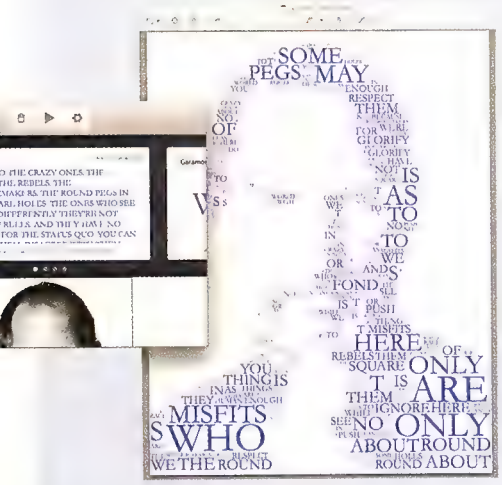
Like a lot of our favourite games, *Twist Pilot!* is a simple little distraction, designed to fill the odd five minutes you've got to kill, rather than dominate your life as you attempt to unravel its mysteries. It's therefore not hard to play. It's a game that started off on iOS, though, so don't get too confused by the occasional instruction to 'tap on screen' – this game won't magically make your Mac a touchscreen device.

You play a little capsule sort of thing, which pretty much rotates constantly. Your goal is to navigate through a series of twisting tunnels and collect gold rings. The trick is that sometimes navigating these tunnels requires very careful timing of your movement with the twisting motion.

There are power-ups that do things like reverse your spin, shrink the capsule to get through tight spaces, or stop it rotating temporarily. You also have to overcome barriers such as locks and doors that open and shut while you're trying to get through them. And that's about it. *Call of Duty* it is not, but fun it is. And we'll have to stop getting Yoda to write these things.

Wordify

$4.49 | tgxmedia.com | tinyurl.com/Wordify



This is a graphics utility that does one thing: it converts photos into 'art' drawn with words instead of lines. It's a simple trick, but an effective one.

You simply drag the image you want to use onto the app window (plain backgrounds are highly recommended) and then click on the 'settings' icon (the little cog) to choose the text you want to use, the font and the colour, plus a few other parameters. Click the 'Play' button, and your artwork is generated and opens in a 'Preview' window as a PDF. Since it's a vector drawing, you can then open it in your graphics editor or publishing program of choice and scale to your heart's content. Pretty cool for under five bucks.

We do wish there was a bit more control over the placement of words in the drawings, but that's a minor quibble, really.

DM1

More than a drum machine.

$5.49 | Fingerlab | tinyurl.com/DM1forMac

DM1 is basically a drum machine, but rather more than that once you dig about in it a bit. For example, the instruments you can choose range from classic drum machines such as Rolands and Korgs, to the Casio and Mattel toys you may have had as a kid, right through to acoustic drum kits and even tuned instruments such as pianos and cellos.

You play the DM1 by creating looping patterns. The loops can be as long or short as you want. Then you build songs out of the loops you create. You can play along with the patterns using drum pads on the screen to add extra live elements and you can add effects.

One very cool aspect of DM1 as opposed to the loop-based composition program we all know and sorta like (GarageBand) is its support for complex time signatures. As lovers of syncopation, we find GarageBand's refusal to create a project in 10/8 downright repressive. DM1 has no such qualms.

DM1 is a powerful tool for serious musicians and an awful lot of fun for amateurs who want to be able to whack out something groovy. You'll be surprised at how easy it can be.

App Store | IOS APPS

Clone Camera

We need a montage.

$1.99 iPhone/$2.99 iPad | Peta Vision | tinyurl.com/CloneCamera

This isn't the most practical of the many camera apps in the App Store, but the one silly impractical thing it does, it does well. Take between two and four photos, moving your subject between shots, and then use very simple masking to mark the bits you want to keep. Then, with a single tap, your photos are combined into a pretty good montage.

The best results are obtained if you can keep the camera steady between shots, so a tripod or stand of some sort is recommended. There's a timer as well, so you can take photos of yourself if you want. It's vastly easier than taking multiple photos and trying to combine them in some other app later.

Jaws Revenge

Free | Fuse Powered Inc. | tinyurl.com/RevengeOfJaws

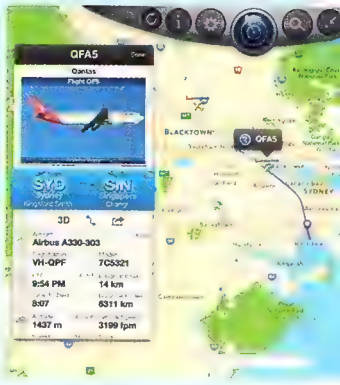
Universal put out a *Jaws* game last year when the movie came out on Blu-ray. In the game, you had to get swimmers out of the water and onto rescue boats before the rampaging shark could take them. It was popular, but we'll make a confession: we didn't like it much.

In *Jaws Revenge* you get to be the shark. You eat fish, swimmers, boats, birds and guys on hang gliders. You swim and you dive and you leap and you frenzy. Maybe it's just us, but we find this far more fun. For one thing, there's more screaming and blood in the water. Whether it in any way resembles the behaviour or capabilities of actual Great White Sharks is a matter for someone else.

Not recommended for children or ichthyologists.

Flightradar24 Pro

$2.99 plus in-app purchases | Svenska Resenatverket AB | tinyurl.com/FlightRadarPro

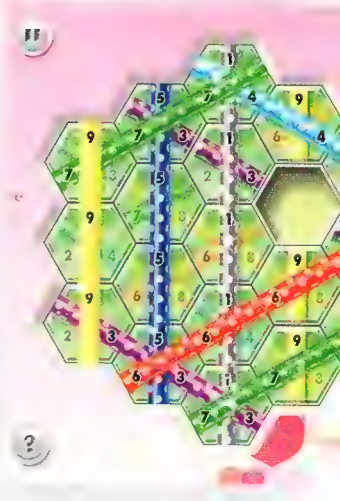


There are a few plane-tracking apps in the App Store, but this is the first one we're aware of that provides near-real-time data as well as integration with flight schedules. You can search for a particular flight and see pretty much exactly where it is, or you can just idly watch all the many airborne vehicles shuttling about at any given time.

You can also display call signs, flight numbers, airline logos and more. Tapping on a particular plane gives you further info about the flight, such as the airliner's model, destination and flight path. In-app purchases can give you better 3D models of the planes, arrival schedules and alerts for 99c each. There's also a free version that just follows planes in flight without all the info, and there's a premium version ($37.99) that gives you all the current features plus all planned future features.

Take It Easy

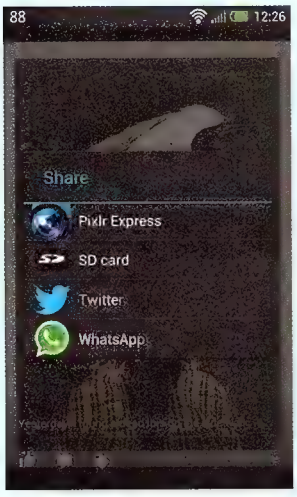
$1.99 | Ravensburger Digital | tinyurl.com/caoxlsw



You probably know Ravensburger as a maker of jigsaw puzzles – that's how we know it anyway. It's a market leader in that field, but it also makes a huge variety of other games and has recently pinned its hopes for future growth on digital gaming, including augmented reality puzzles that combine real-world cardboard with digital images – it's all very cool.

Take It Easy is a simple yet addictive puzzle game in which you try to join up lines of matching colours on a honeycomb grid to score points. It looks childishly easy, but it turns out to be brain-snappingly hard at times. There are achievements to collect and a multiplayer mode, too.

Well worth your time and a couple of bucks.

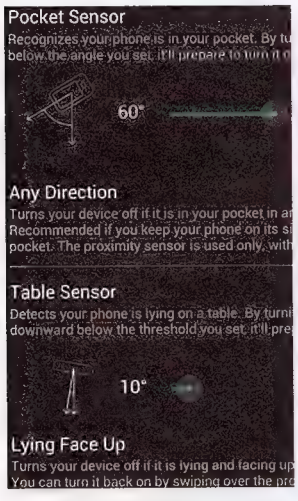


Send to SD card

Free | Denis Nelubin | tinyurl.com/lggfae4

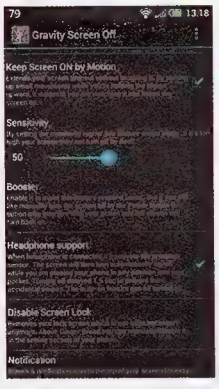
This nifty little app allows you to quickly move or copy a file on your handset between folders – regardless of which app you're currently viewing it in. Perhaps more niftily, however, is that you can have it download files from other apps (we use it to save images from Facebook).

It does this by placing an 'SD Card' entry in the universal Android 'Share' menu. So, from within an app, just hit 'Share' and then 'SD Card'. Note that some applications just pass on a URL when sharing (YouTube, Instagram et al), so you can't grab *every* file.

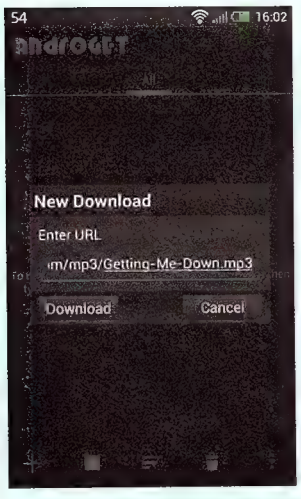


Gravity Screen Off

Free/$1.99 Pro | Plexnor | tinyurl.com/mltglyz



This app was designed to allow you to slip your device into your pocket without having to worry about remembering to lock the screen. It does this by monitoring both the angle of your device and the proximity sensor. Additionally, you can have it keep the screen from timing out while it's in your hand. If you have a flip case that covers the screen, it's a handy way to add 'smart cover' functionality to a device without it.

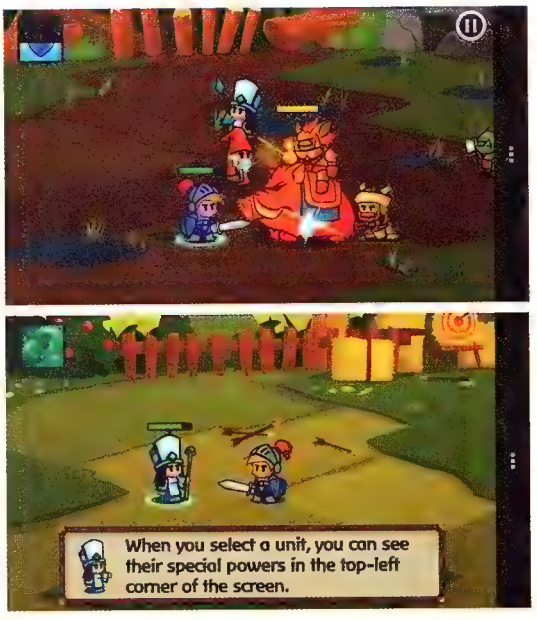


AndroGET Pro

Free/$1.88 Pro | Salama Akilimali B | tinyurl.com/mnqnsv7

AndroGET Pro is a download accelerator that allows you to download files a little quicker than you otherwise would be able to. It also helps keep your download folder organised by placing each downloaded file within a contextual subfolder, such as 'images', 'videos' and so on.

Depending on your browser, downloads can be passed to the app by long-pressing a download link and 'sharing' the link to AndroGET Pro via the Android 'Share' menu (otherwise copy/paste will do). The Pro version also includes an improved interface with themes, credentials management and plug-in support (including a widget).



Battleheart

RPG perfectly made for the mobile platform.

$2.84 | Mika Mobile | tinyurl.com/7cpm9xr

Battleheart is a game that – we'll admit, like many great Android apps – started its life on iOS, where it received great acclaim. The Android version has thankfully been faithfully ported to our most beloved platform.

The premise is that a great kingdom is under siege from evil monsters and you have to rustle a troupe together to battle said evil. You command a party of up to four adventurers, including anything from wizards to healers, knights and kung-fu guys, with all the possibilities between.

Members are recruited at the local tavern by offering gold and upgrades are purchased at the armoury. Special abilities improve as characters level up from XP gained through fights. The battles are short yet challenging and the difficulty quickly escalates, so you don't have to go through a billion training levels before you actually come across a level you can't pass on the first go.

It's all standard RPG fare, really, and it doesn't really get much more complicated than equipment and special abilities. This is perfect for the mobile platform, where most people just want a game they can quickly dive into between stops during a commute. Yet, we've found that we can just as easily keep playing it until we need to reach for our chargers.

Windows Store | WIN PHONE 8

Chronos Calendar

A gorgeous calendar, with functionality to match.

$2.49 | AR-1 | tinyurl.com/kx92evk

The Windows Phone calendar is functional, but sometimes you don't realise what you put up with until something new comes along.

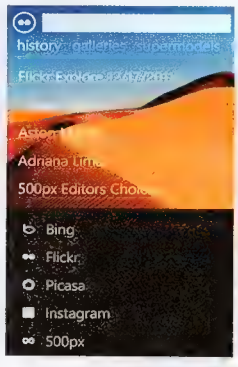
Chronos Calendar makes a startling first impression with its attractive aesthetic – the use of muted yellows and browns gives it a manilla envelope sort of feel, without going so far as to evoke a '70s bachelor pad. The colour scheme, while initially impressive, obviously isn't the highlight of the app; the two-paned interface provides you with quick navigation between days of the month down below – including showing which days have events – while the selected day's agenda sits up the top.

Perhaps best of all, however (certainly for us) is the budding support for Google Calendar as well as Windows Phone or other Microsoft calendars. We say 'budding' because at the time of writing, Google Calendar support was still marked as experimental, although we couldn't find problems with it.

You can also fully customise the Live Tile, tweaking it just the way you want by displaying as many future events as you need, as well as the amount of information displayed for each of them. In terms of functionality, aesthetic and customisability, Chronos Calendar is unsurpassed and highly recommended.

das Image

Free | das Geek Software | tinyurl.com/labdc2r



If you're looking for that perfect image for, say, your lock screen, das Image allows you to search or browse the most popular image sites online, including Flickr, Picasa, 500px, FFFFound!, Instagram and even Bing.

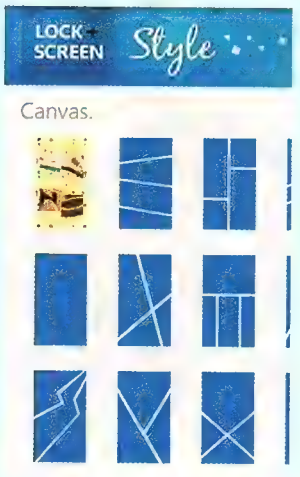
You can browse by categories or type in a search query – your favourite queries can be saved for access later – and then simply swipe through the results. Images can be saved for use as a lock screen, sent to friends or shared to Facebook.

[+]Lockscreen Style

Free | Snack Studio | tinyurl.com/mk4etw7

When a single image isn't enough, [+]Lockscreen Style allows you to take your lock screen to the next level by combining multiple images, applying different filters and even adding text. The app comes with 12 layout templates to choose from, or you can take some inspiration and create your own.

Images can be added in any shape, rotated, resized, borders added or removed, and effects applied. With this many options, there's almost no limit to what you could create.



Blueprints

99c | José H. Arriaga | tinyurl.com/mb6q9ac

For anyone who has a Tumblr account, a decent mobile app is a must-have – being able to post thoughts as soon as inspiration strikes often means the difference between an insightful post or nothing at all. Beyond posting, though, you can also reblog and like posts on the go with Blueprints.

However, if you don't run a Tumblr, you can use the app to keep track of and view all the Tumblr accounts you follow, keeping you abreast of all the latest goings on in Tumblrtown.

PicFrame

99c | Active Development Limited | tinyurl.com/m89zdsu

With PicFrame, you can slap up to five images together into a single, divided frame, creating a collage that best represents that most precious memory/meal. In addition to choosing your layout, you also get to choose the aspect ratio of the collage, the shape of each frame, the roundness of its corners and the colour (or pattern) of the borders.

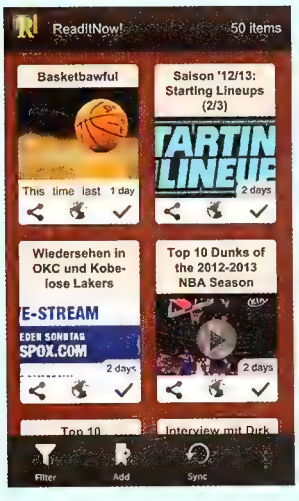
You can minimally play with some filters, but best results will be realised by then sharing the image out to your favourite retro-trendy photo editing app of choice.

Filter Box

99c | I&N MobiSoft | tinyurl.com/ksrhlfx

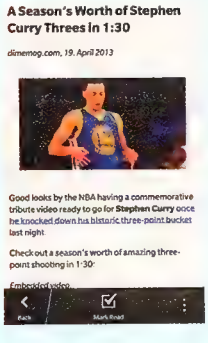
Looking for something more than just frames for the images snapped on your new BlackBerry? Filters allow you to turn a rather mundane photo into something that borders on arty. Filter Box comes with more than 30 filters, so you'll never have to worry about your photos all looking rather same-same.

In addition to the filters, there are also more than 20 light leaks and a selection of frames, as well as a host of standard editing features, such as cropping.



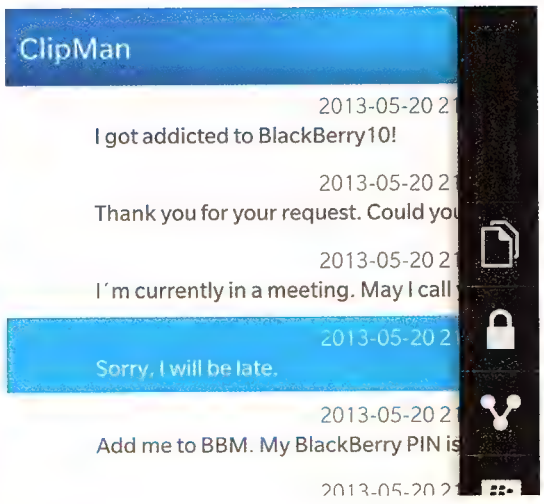
ReadItNow! – Pocket client

$1.99 | Sven Ziegler | tinyurl.com/lzj6uao


A Season's Worth of Stephen Curry Threes in 1:30
dimemag.com, 19. April 2013
Good looks by the NBA having a commemorative tribute video ready to go for Stephen Curry once he knocked down his historic three-point bucket last night.
Check out a season's worth of amazing three-point shooting in 1:30:
Embedded video

If you're a Pocket user, you'll no doubt be interested in adding the offline reading capabilities of the service to your BB10 device – especially handy if you have a tablet or other device on another platform and want to read articles on the two devices.

In case you don't already know, Pocket – just like its main competitor, Instapaper – offers a way to save articles, pictures and other miscellanea found online, for later offline reading on any of your devices, presented in a simple, clean, distraction-free interface.



ClipMan Clipboard Manager

Powerful management of your clipboard and its history.

99c | QtHelex | tinyurl.com/k2fyocm

ClipMan offers a handy way to quickly access all the items recently placed on your clipboard – no more accidentally erasing a long, secure password. Of course, if you're copying passwords to your clipboard, you don't want them to remain in this app's history, so clearing the history is thankfully a breeze.

Another super bonus use case? Placing all your canned email/BBM responses in the app so that you can quickly respond to messages when you don't have the time to type them out. Of course, this wouldn't be of much use when you clear out all the junk in your history, so thankfully there's a 'protect' option for any item in the list – just long-press it and click on the padlock icon.

Sharing these responses directly to other apps is also just a matter of long-pressing the response you want – you can immediately choose from a BBM user or group, or over NFC – or selecting the 'Share' icon to send it to any other app that you wish.

Additionally, text can be sent directly to ClipMan using the 'Share' function after highlighting text in any other app, bypassing the need to stick it to the clipboard first.

ORGANISE WORK WITH YOUR OWNCLOUD

Want universal access to your local work files, even on the move? Mayank Sharma explains how.

YOU'LL NEED THIS

A WEB SERVER

The ownCloud software runs on a web server. We'll show you how to set one up on top of Ubuntu Linux, but you can use ownCloud on top of any Linux distribution with the Apache web server, or on Windows with the IIS web server.

OWNCLOUD

This is the server software that will organise your files and let you access them from any online computer. Download it from **owncloud.org**.

For some time now, many businesses – both big and small – have relied on the combination of Google Docs and an online storage duffel bag like Dropbox to be productive while on the move, but these come at a cost. For services like Dropbox, you part with real money and with services like Google Docs, you part with your privacy. For the privacy-minded among us, the idea of uploading confidential work files to a remote server outside our jurisdiction can seem preposterous. This is where personal cloud storage software like ownCloud steps in. With ownCloud you can sync and share private data through a secure encrypted channel. Best of all, the data never leaves your computer and yet it's accessible through any PC connected to the internet. And how much does it cost? Zilch, zero, nada!

OWN YOUR CLOUD

ownCloud is an open-source project that was launched in January 2010. It took a while to get going, but is now at full steam and its developers plan four new releases a year. The latest version, ownCloud 5.0, improves existing capabilities and introduces a couple of features that make it suitable for organising your work files.

ownCloud's impressive online file manager can handle files in a variety of formats, so you can view and edit simple text files, as well as files in Open Document Format (like ODT, ODP and ODS) from within the browser itself. It can also handle images and music files in the most popular formats, and has a built-in gallery image viewer and music player. The latest version can also encrypt your files.

Another new productivity feature is file versioning, which comes in especially handy, since with ownCloud you can share your files with multiple users. You can also sync your calendar and address book with those on your desktop and mobile, and share them with other ownCloud users.

SIMPLE & EXTENSIBLE

You can access ownCloud through a web browser or a desktop client. Using the desktop clients you can easily sync as many folders as you want, but you don't need to install the client if all you want to do is upload files. Simply log in to your ownCloud server in the browser, navigate to the folder of your choice and then drag and drop the files from your desktop straight into the browser window.

Besides the inbuilt features, you can also extend your ownCloud server by enabling apps – to use it as a bookmark manager, for example.

INSTALL THE SERVER

Installing server software usually requires nerves of steel, but ownCloud is a welcome change. First, ensure you have the essential building blocks at hand – primarily, the Apache web server, the PHP5 scripting language and a bunch of dependencies. You don't need a database server like MySQL because ownCloud manages your data with SQLite.

On an Ubuntu installation, you can fetch the required packages by launching a terminal and then issuing the following commands:

```
$ sudo apt-get install apache2 php5
php5-json php-xml php-mbstring
php5-zip php5-gd
$ sudo apt-get install php5-sqlite
curl libcurl3 libcurl3-dev php5-curl
php-pdo
```

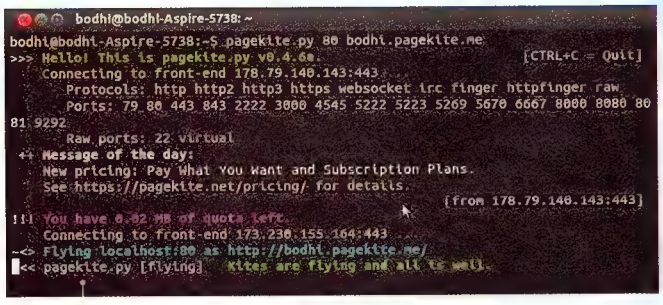
Next, head to **owncloud.org/news** and download the latest stable release. Extract it and copy it to the document root folder in your web server, which in Ubuntu would be /var/www:

```
$ tar -xjf owncloud-x.x.x.tar.bz2
$ cp -r owncloud /var/www/
owncloud
```

Next, you need to create a data/ directory under your web server and set appropriate access permissions:

```
$ cd /var/www/owncloud
$ mkdir data
$ chmod 750 data/
```

Ensure the data and config directories are owned by the user who can manage the web server. Again, in Ubuntu this is the www-data user:


bodhi@bodhi-Aspire-5738: ~
bodhi@bodhi-Aspire-5738:~$ pagekite.py 80 bodhi.pagekite.me
>>> Hello! This is pagekite.py v0.4.6a. [CTRL+C = Quit]
Connecting to front-end 178.79.140.143:443
Protocols: http http2 http3 https websocket irc finger httpfinger raw
Ports: 79 80 443 843 2222 3000 4545 5222 5223 5269 5670 6667 8000 8080 80
81 9292
Raw ports: 22 virtual
<- Message of the day:
New pricing: Pay What You Want and Subscription Plans.
See https://pagekite.net/pricing/ for details.
[from 178.79.140.143:443]
!!! You have 0.02 MB of quota left.
Connecting to front-end 173.230.155.164:443
~<> Flying localhost:80 as http://bodhi.pagekite.me/
<< pagekite.py [flying] Kites are flying and all is well.

PageKite is built using free software. Refer to the quickstart guide at **pagekite.net/support/quickstart** for more advanced options.

Access ownCloud from the web

The advantage of commercial cloud services like Dropbox is that you can access data stored within them from any computer connected to the net. By default, ownCloud will only be accessible from computers within the network it's set up on, but you can access your private cloud from the internet. The trickier – and more expensive – solution is to get a static IP address from your ISP and poke holes in your router's firewall to let traffic from the internet find your cloud. The smart way is to use a tunnelling service like PageKite, which can make your private cloud visible to visitors with minimum effort. It's a paid service with plans starting from US$4 a month, but everyone gets a free trial period of 31 days. First, you need to install PageKite, which on Linux can be done with a single command:

```
$ curl -s https://pagekite.net/pk/ |
sudo bash
```

Then, make your local web server public with the following command:

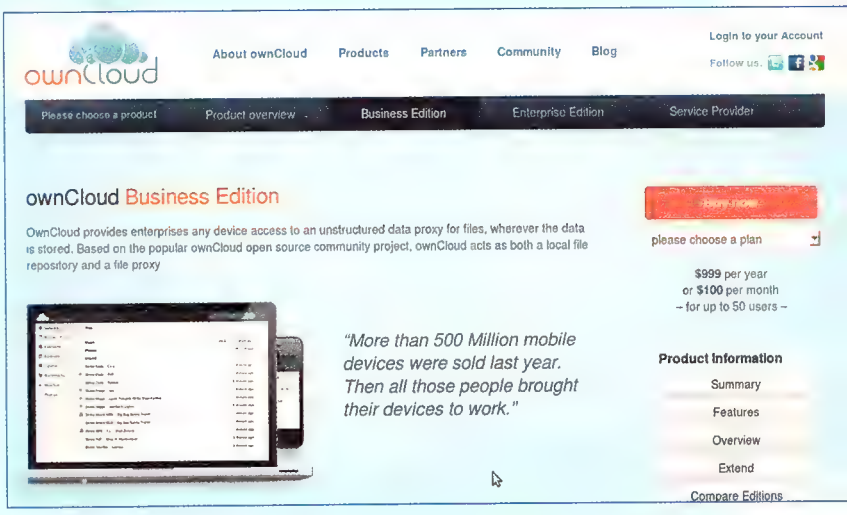
```
$ pagekite.py 80 <your-name>.pagekite.me
```

Now you can access your ownCloud instance at the **<*your-name*>.pagekite.me** URL. The first time you run this command, PageKite will run you through its brief signup process and ask for your email address.

Commercial use

ownCloud has launched its Business and Enterprise editions. These have the same features as the freely available community edition, albeit with extra management capabilities and support. The Business edition, starting at US$100 a month, is designed for businesses with up to 50 users, while the Enterprise edition, which starts at US$1,500 a month, can handle up to 250 users. Another advantage is that OEMs can rebrand them to create their own hosted cloud file-sharing services.

The commercial editions are certified by ownCloud Inc. and come with support options for the server, the desktop and mobile clients. These releases are rolled out as updates to the community edition, so if you're using the community edition, all you need to do to move to the commercial editions is install the update. The community and commercial releases are linked and updates to the commercial packages will be made available within two months of a community release.


ownCloud
About ownCloud
Products
Partners
Community
Blog
Login to your Account
Follow us.
Please choose a product
Product overview
Business Edition
Enterprise Edition
Service Provider
ownCloud Business Edition
OwnCloud provides enterprises any device access to an unstructured data proxy for files, wherever the data is stored. Based on the popular ownCloud open source community project, ownCloud acts as both a local file repository and a file proxy
"More than 500 Million mobile devices were sold last year. Then all those people brought their devices to work."
please choose a plan
$999 per year
or $100 per month
– for up to 50 users –
Product Information
Summary
Features
Overview
Extend
Compare Editions

The commercial releases are currently built around version 3 of ownCloud.

```
$ chown -R www-data:www-data /
var/www/owncloud/data
$ chown -R www-data:www-data /
var/www/owncloud/config
```

Now, point your web browser at 'localhost/owncloud', follow the setup wizard and configure your server as shown in the guide on page 74.

If you're running a Linux distribution besides Ubuntu, check out distro-specific installation notes at **owncloud.org/support/distro-notes**. On the other hand, if you want to set up ownCloud on a Windows machine with the IIS web server, follow the instructions at **owncloud.org/support/windows-server**.

USING THE SERVER

Once you've set it up, you're ready to upload your data to your ownCloud installation. Point the web browser to the server and log in with the administrator credentials you specified during setup.

The ownCloud interface is easy to follow. Once you've logged in, you'll be at the 'Files' tab. To upload a file, click on the green arrow button or just drag and drop files from your desktop. To organise your files into folders, click on the green button labelled 'New' and select the 'Folder' option from the drop-down menu.

If you've uploaded a file in a format that ownCloud understands, you can click on its name to view and edit it. If it's an audio file, head to the 'Music' tab. Here you'll see a list of all the music files in your cloud. At the top of the page you get buttons to control playback. Simply click on a file to add it to the playlist.

Click the 'Pictures' tab to see thumbnails of the images on your cloud. Click on an image to view it in a Lightbox, which has controls to jump to the next and previous images.

Uploading and sharing files with ownCloud is easy, as shown in the 'Organise your files' guide on page 74. You can also share an item with someone who isn't on your ownCloud server. When you click on the 'Share with private link' checkbox, ownCloud will display a link to the item that you can share with anybody on the internet.

SYNC CLIENTS

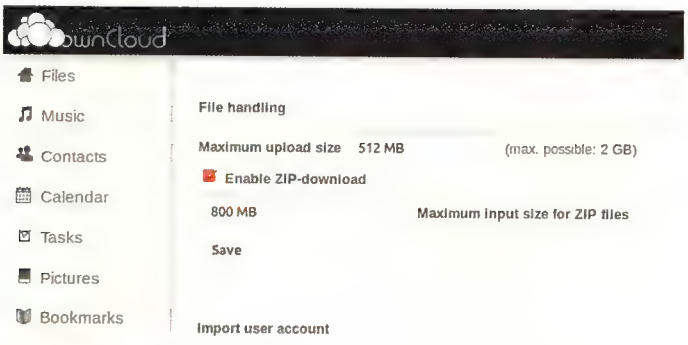
To sync folders from any desktop to your ownCloud server, you'll have to install a client. Helpfully, ownCloud has clients for Windows, Mac OS and Linux. Head to the Sync Clients page (**owncloud.org/sync-clients**) to download the client for your OS. The clients for Windows and Mac OS are executables that you can install like any other app. For Linux, there are instructions for adding ownCloud repositories to your distro's package manager, and fetching and installing the client from there. In addition, there are ownCloud mobile clients available for both iOS and Android platforms.

CONFIGURE OWNCLOUD

Get your cloud up and running.

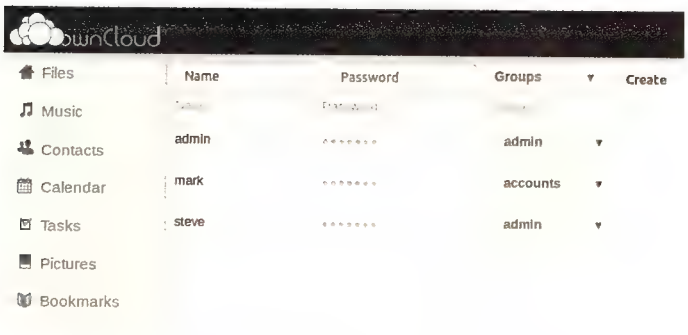
01 INITIAL SETUP

After you've installed ownCloud on your web server, fire up a web browser and navigate to the ownCloud instance. If you've installed it on the same machine you're accessing it from, you'll find it at **http://localhost** or **http://localhost/owncloud** if you installed it under the ownCloud folder. Here you'll be asked to create a user account for the administrator.



02 CLOUD SETTINGS

That's it. You'll now be logged into your ownCloud server. In the main interface, click on the gear icon in the bottom-left corner of the window. This will bring up the 'Settings' menu. Click on the 'Admin' option, which displays several configurable parameters. You can alter the maximum upload size for a single file and disable version control for files.



03 USER MANAGEMENT

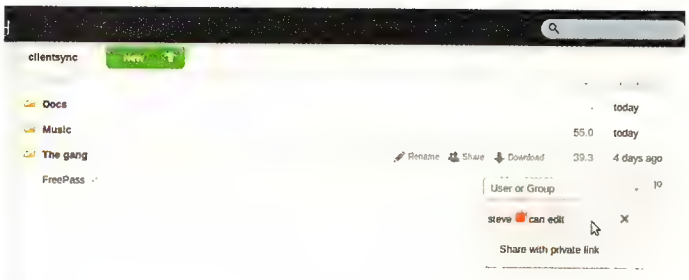
Before you start using your ownCloud instance, it's advisable to add users and organise them into different groups. If you're using this in a small office, you can create groups for different departments and add users underneath them. These users can manage their accounts, change passwords and alter other settings from 'Personal'.

ORGANISE YOUR FILES

How to manage files in your cloud.

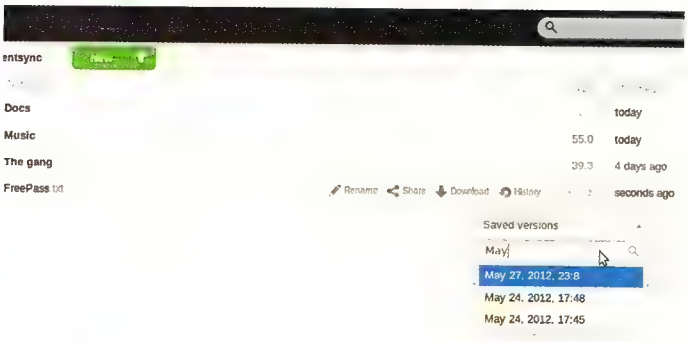
01 UPLOAD

Before you can sync files, you need to upload them to the cloud. There are two different ways of doing so. The easiest is to use the web interface to create folders and then either upload files or drag and drop them within the browser itself. Alternatively, you can install a desktop client that allows you to automatically sync multiple folders.



02 SHARE

To share the uploaded files, go to the 'Files' section in the web interface and hover over the file or folder you wish to share. This will display several options, including 'Share'. This allows you to select which users or groups you want to share the item with and enables you to specify whether you want to give them permission to modify the files.

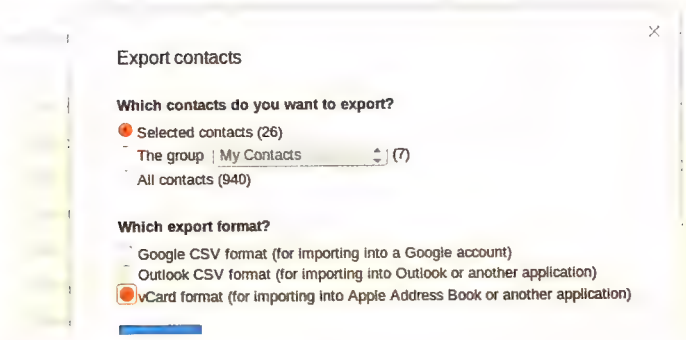


03 VERSION CONTROL

You can edit files from within ownCloud itself, which supports various common file types. You can also track changes to a file with its built-in version control system. Just hover over a file and select the 'History' option to view all its different versions. This is especially handy when you're sharing the files with others and they have permission to edit your files.

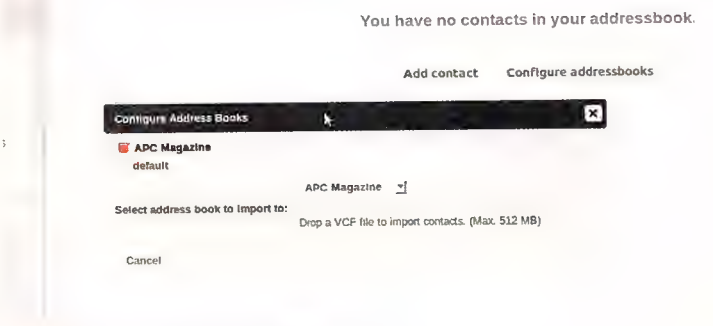
KEEP YOUR CALENDAR & ADDRESS BOOK IN SYNC

Import them into the cloud and sync across desktop and devices.


Export contacts
Which contacts do you want to export?
Selected contacts (26)
The group | My Contacts | (7)
All contacts (940)
Which export format?
Google CSV format (for importing into a Google account)
Outlook CSV format (for importing into Outlook or another application)
vCard format (for importing into Apple Address Book or another application)

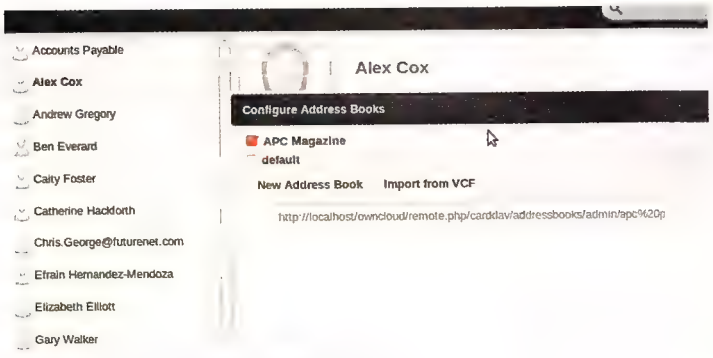
01 EXPORT CONTACTS

With ownCloud you can keep your contacts in sync. Before you can do that, however, you need to get them into your ownCloud instance. Since it supports the popular vCard file format (with the VCF file extension) and almost every popular emailing app, including online ones like Gmail, it will export their address book in this format.



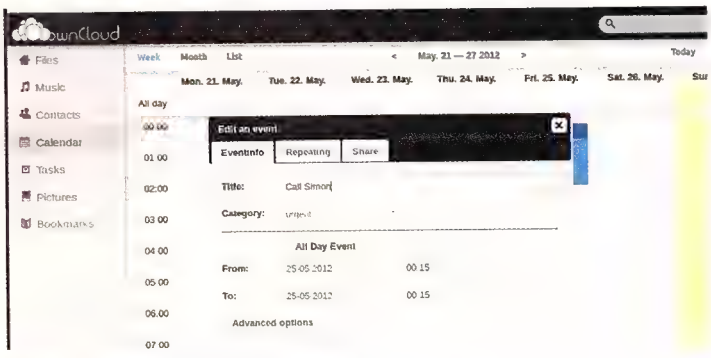
02 IMPORT INTO OWNCLOUD

With the VCF file in hand, head to the 'Contacts' tab in the ownCloud interface and click on 'Configure AddressBooks'. The 'New AddressBook' button will help you create a new address book to import your contacts into. Now click on the 'Import from VCF' button and drag and drop the VCF file into the space provided.



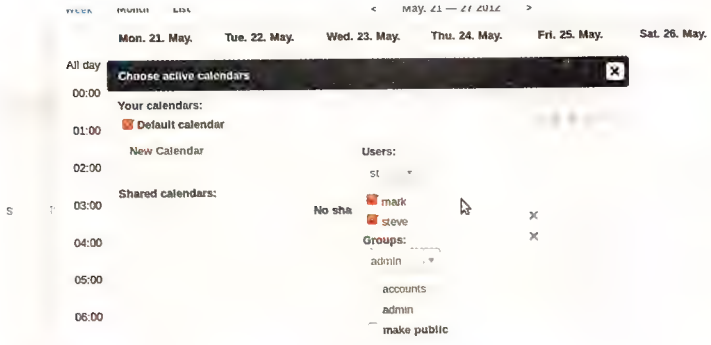
03 SYNC THE ADDRESS BOOK

You can sync the address book with clients that can read CardDAV links. Head over to the 'Contacts' tab, click on the gear icon at the bottom, hover over the name of the address book you just imported and click on the first icon. This will spit out a CardDAV link for this address book, which you can feed to your desktop or mobile address book client.



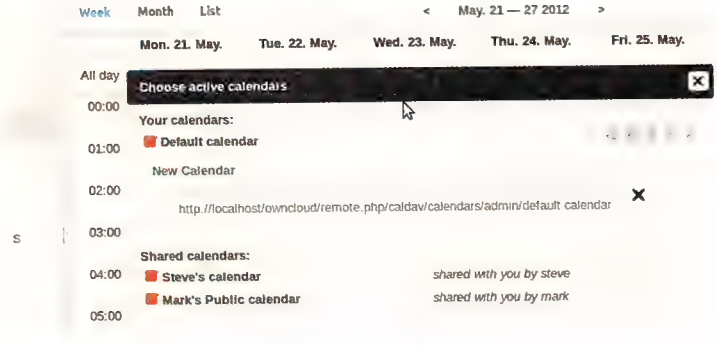
04 EDIT THE CALENDAR

Additionally, ownCloud can manage your calendar and tasks. To create an event in your calendar, head over to the 'Calendar' tab. You can view the calendar for the entire month or just the current week. To add an event, click anywhere on the calendar. This will bring up a window that gives you several options to configure the event.



05 SHARE WITH OTHERS

After you've saved an event, you can use ownCloud to share it with other users. Click on the 'Calendars' button in the top-right corner. Hover over the calendar you wish to share and click on the 'Share Calendar' icon. This brings up a pull-down menu, which lets you select the users or the group of users you wish to share the calendar with.



06 SYNC WITH THE DESKTOP

Just like the address book, ownCloud can also sync your calendars with desktop and mobile apps that can read this information from CalDAV links. To get the CalDAV link for your calendar, click 'Calendars' and then click on the second icon. This will display the link that you can pass to the clients to keep them in sync with the ownCloud calendar. ADC

UPGRADE YOUR IT GEAR BEFORE EOFY

New tax rules let businesses update nearly all their IT equipment before June 30 and claim the lot. David Braue explains how they work.

Ask your accountant to name one tax benefit you should take advantage of before the end of financial year (EOFY) and odds are that they'll nominate the dramatic jump in the small business instant asset write-off threshold to $6,500.

This change, which was introduced for the first time in the financial year that ends June 30, was a dramatic step for the Australian Taxation Office (ATO), which has historically burdened small businesses with a significant volume of paperwork by forcing them to depreciate any capital asset that's purchased for more than $1,000. That will buy you a lot of things in the IT world, but not the moderate and high-powered laptops, desktops, network switches, workgroup printers, digital cameras, security systems and servers that form the backbone of any company's IT infrastructure.

Thanks to the new changes to Subdivision 328-D, however, you can buy any equipment your business needs by June 30, up to a GST-inclusive price of $7,150, and write off the entire amount in your FY2012-13 returns (the GST component will be claimed back on your quarterly Business Activity Statement). Companies buying single equipment that costs more than $7,150 (including GST) will have to depreciate it the conventional way, although there's little IT in regular use by most businesses that costs anywhere near that much.

The difference under the new rules can put a significant amount of money into the pockets of companies requiring additional computing equipment. Under past rules, for example, a $5,000 server would have to be depreciated over an effective life of four years – under which, assuming a 25% annual depreciation expense, would allow for a $1,250 deduction that would put $375 of avoided tax back into your company's account. This amount would be pro-rated, meaning that if you bought the server on June 30 you would effectively get a little over $1 in avoided tax.

Under the new rules, that $5,000 server can be written off completely no matter when you buy it: pick it up on June 30 at 4:59pm and you'll still be able to claim the whole $5,000, putting $1,500 (at a 30% company tax rate) back into your company accounts for the year. This could make a big difference for some companies.

"For those thinking about getting new servers, printers and those kinds of things, it's very much a huge incentive this year," says 'Mr Taxman' Adrian Raftery, an accountant and author of the annually updated *101 Ways to Save Money on Your Tax – Legally!*.

"That will work for businesses and anyone who works in the IT industry," he continues. "Their bosses may have been really tight over the years in terms of getting IT purchases through, so this is definitely something to let your bosses know about this year. If you're a small business, why don't you just upgrade your system and have it subsidised by the ATO?"

CLOUD SHOPPING

Here's the kicker: while the ATO's new policies allow for unprecedented flexibility when purchasing IT-related capital equipment, in a good small business environment you may well be looking far past the purchase of new servers and desktops to build your IT strategy.

Thanks to continually evolving cloud services, many small businesses in particular are steadily migrating to cloud-delivered software for everything from productivity tools like Microsoft Office 365 to photo management services like SmugMug, security services like Symantec. cloud, accounting software like Xero, cloud storage services like Dropbox, CRM tools from **SalesForce.com** and graphics suites like Adobe Creative Cloud. Some companies even rent entire Windows desktops from the cloud through a virtual desktop infrastructure (VDI) service.

All of these and more are available through regular subscription models and rely more on the speed of your broadband services than the processing grunt of your computers. And if you're willing to consider their options, the ability to access those key business capabilities on an as-needed basis offers equally revolutionary cost savings.

Better still, if you're looking for EOFY cost savings, you can prepay up to 12 months' access to cloud services and claim the whole amount in your 2012-2013 tax. That may not produce the same feelgood, massive savings feelings as getting a big write-off under Subdivision 328-D, but if

you do the maths you may find that embracing cloud services makes more financial sense for many employees than shelling out on more powerful desktops, laptops or servers.

It's important to note that if you do prepay on cloud services and then cancel them during the year, you'll have to pro-rate the period during which you did use the services, and then claim an adjustment to reflect this.

KEEPING UP

Because they do most of their computing on the other end, many cloud services will run just as quickly on older hardware as on new hardware. This makes them a way of not only restructuring your IT spend, but escaping the ongoing costs of hardware maintenance and management that comes with nearly everything that plugs into your network.

The cost of this last point is a very real issue for small businesses: a recent Dick Smith study of more than 500 Australians found that we waste 71 million hours every year resolving technical issues like paper jams, printer and photocopier issues, and computer crashes. Furthermore, one-fifth of respondents had spent an entire working day to resolve an IT problem.

The use of old technology was named as a common source of the problem, so if you're expecting cloud services to revive that eight-year-old desktop, you're probably out of luck. However, if you've bought computers within the past few years, you may find they're fast enough and capable enough to keep up.

As a rule of thumb, the use of Windows 7 may be a good sign that they're modern enough; by contrast, if you're still running Windows XP and like the look of Windows 8, it may be worth splashing out on faster, new systems to support it. After all, Microsoft will completely stop supporting Windows XP forever on April 8, 2014 – during the coming tax year. That's not a great place to be for any small business; in today's IT world, you don't want to be caught with unsupported desktops that are two operating system versions behind the curve.

FIVE WAYS TO MINIMISE YOUR IT-RELATED TAX

- Claim deductions for home office costs. If you're working at home – even part time or even if a room isn't set aside exclusively for work-related purposes – you can still claim deductions on the work-related portion of your home telephone, internet access, stationery, computer equipment and printers. You can also claim a 34c/hour deduction for electricity, gas and depreciation of home-based furniture.
- Keep your receipts. This will come as no surprise to people who have done tax before, but in today's era of paperless bills and emailed receipts, keeping receipts can be trickier and tricker. Make sure you have a system for storing all of your digital bills, even if it's just dumping them into a hard drive folder with some regularity. Make sure you have 12 regular bills at the end of each accounting period and dig out the ones you're missing. Scan receipts so you have a record of them, even if you lose the originals. And print out your bills if you must, since the ATO will need them if your deductions are ever questioned.
- Upgrade your IT equipment. New rules raise the deductability threshold from $1,000 to $6,500, meaning that small businesses can now claim the entire cost of nearly any type of IT equipment they're likely to require. Furthermore, the deductions don't have to be pro-rated throughout the year. If you plan right and pay for your equipment by June 30, you could put thousands of dollars back in your business accounts.
- Prepay services. Tax law allows you to prepay up to 12 months' worth of any recurring business-related expense. That used to only include relative tangibles like internet access and mobile phone plans, but with the rise of cloud computing subscriptions, you now have a whole range of new deductions that can be claimed before June 30. If you end up cancelling the services during the coming year, you can pro-rate them and fix the discrepancy on next year's tax return.
- Stock up. Because office supplies are deductible, it's worth a trip to your local Officeworks or equivalent to make sure you have as much printing paper, pens, toner cartridges, manila folders, binders and other consumables that you use on a regular basis. This also includes external hard drives, smartphone and tablet cases and charging cables, UPSs and more. Hit the sales if you can – just don't spend more than you can afford.

Update any sort of IT-related tech such as printers or keyboards before June 30, and you'll be able to claim the lot.

While you may feel the temptation to squeeze absolutely every last day out of your IT assets, the continuing pace of technological change means that performance isn't the only issue you face when choosing to upgrade your tech: security exploits on older operating systems are so well understood, with so many new ones discovered every day, that it's actually becoming dangerous to use old computer platforms on today's internet.

This dynamic may well strengthen the case for hiring your desktops from a VDI provider, although in reality, most companies still have slow enough broadband links that relying on them for everyday computing is likely to prove an exercise in frustration.

BUDGET CHANGES

Interestingly, the Dick Smith survey also found that 55% of businesses weren't aware of the tax incentives that would support the purchase of new equipment. They would, however, be aware of the restrictions imposed during the 2013-14 Federal Budget, which was closely watched on the accounting front, since the need to find savings anywhere possible meant the Gillard government had to make some significant changes to existing measures.

One change of note in the IT world is the decision to put a $2,000 annual cap on previously unlimited education expenses. This cap, announced in the leadup to the 2013-2014 budget, is expected to save the government around $520 million over the forward estimates period, but could hit some people hard if they're relying on deductions to cost-justify training in productivity tools, quality assurance standards, security certifications and the like.

Companies currently pay no fringe benefits tax on education and training they provide to employees, and that treatment will be retained to encourage companies to continue investing in their staff. However, for individuals the new changes may mean some significant changes, especially for contractors who rely on keeping their technical skills up to date in order to win or keep key contracts.

The government has argued that the average claim under current laws is $905 per person per year, so the changes may not hit many people to a great extent. However, if you've been considering brushing up on your skills, you may want to bring forward your plans and do as much of the education as you can in the year before this change kicks in on July 1, 2014.

"This will be the last year you can ramp up your study claims," Raftery explains. "It's definitely a disincentive to further training, but they're banking that if you're genuine about increasing your skills, you will do it anyway."

STOCKING UP

Even if you're not dropping significant capex funding on new equipment, you can claw some tax back from the ATO by stocking up on supplies before June 30. It's an oldie, but a goodie, and it's as relevant this year as any year.

Office supplies are deductible, after all, so drop by your local Officeworks or equivalent to make sure you have as much printing paper, pens, inkjet and toner cartridges, manila folders, sticky notes, binders and other consumables that you use on a regular basis.

For IT-reliant organisations, this also includes external hard drives (for backup or movement of large documents), smartphone and tablet cases and charging cables, uninterruptible power supplies (UPSs) and more.

This last point may be particularly useful for small businesses. If you don't already have a UPS powering every key computer, think about investing in one – too-frequent power outages aren't great for equipment and they can be a massive hit to office productivity by shutting off staff computers before they get a chance to save that massive, important document. The lost time and data will probably cost you way more than a UPS to avoid it.

For a few hundred dollars you can get a unit capable of powering a desktop or server for 15 minutes or more – long enough to ride out most power outages and certainly long enough to power down equipment gracefully. Just remember to factor in the power requirements of your network switches and broadband modems, so your systems can talk to each other long enough.

Hit the sales if you can – just don't buy only for the tax deduction and don't spend more than you can afford. "The only restriction is taxable income," Raftery advises. "If you only have a taxable income of $30k, don't spend $60k on gadgets. But if you want to get the taxable income down swiftly, there is definitely a way." ADC

TECH life AUSTRALIA

TECH life AUSTRALIA
RESTARTING WINDOWS 8
HOW THE 8.1 UPDATE WILL FIX MICROSOFT'S FLOUNDERING OS
TOOLS & GUIDES FOR DOING IT YOURSELF RIGHT NOW
GALAXY S4 vs HTC ONE
HAS SAMSUNG BEEN DETHRONED?
HOW TO USE CAD SOFTWARE TO CREATE PRINTABLE DESIGNS
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LAPTOPS

NO BACKLIGHT

Q I own a Toshiba Satellite laptop. After working fine the previous day, the machine starts without a backlight. I've tried taking out the battery and holding the power button and so on. I've even recovered it to its default factory settings, with no luck at resolution. Please advise as to what I could possibly do to remedy my device's sad state.
Irnol Fourie

A We have grown lazy. If something doesn't work, we turn it off and back on again. This is a good strategy for software problems because every time you reboot, your digital world is made anew. However, it's a terrible solution for a blown inverter board in your laptop backlight circuit.

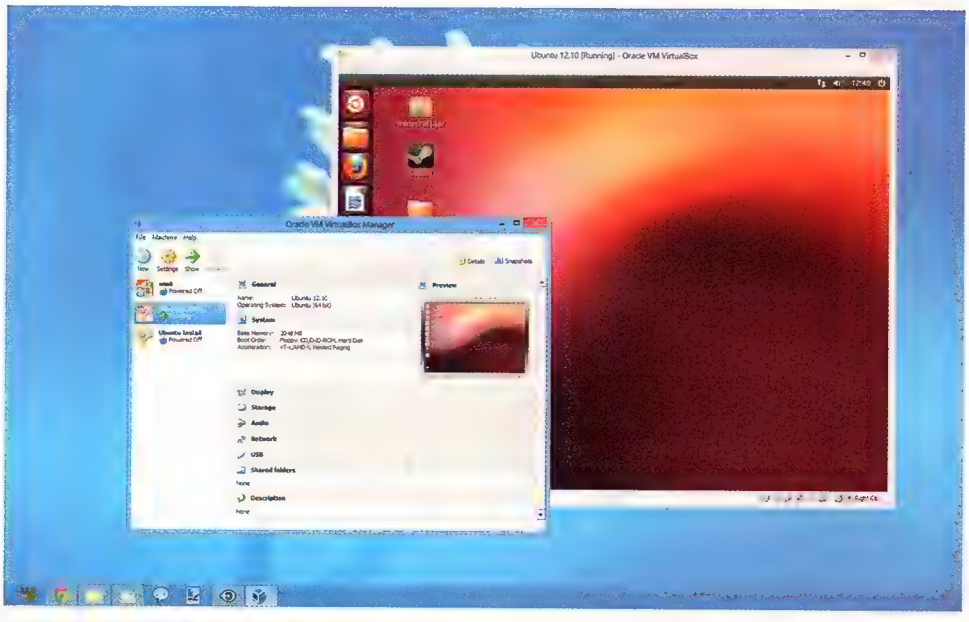
Modern laptops use LED backlights now, but we can tell yours isn't one of those because LED backlights don't blow. The older type uses a cold-cathode fluorescent tube (CCFT) and the bulbs themselves are nearly as reliable as LEDs, although the inverter circuits that supply them with AC power blow like gangbusters. You can get yours replaced at any competent computer store, but it's a fairly common DIY job. Expect to pay no more than $50 for a replacement board.

SOFTWARE

PLACEBO PROTECTION

Q Is it necessary to install antivirus software in a virtual machine? And OS updates?
Julio Mita

A Keeping Windows fully patched and not clicking on silly things is enough to keep most of the nasties out of your PC, although an antivirus program is essential. Booting into Safe Mode with Networking and running the online scan at **housecall.trendmicro.com** is also a good idea if you suspect you might be infected. If you want to be really thorough, you can create a slipstreamed bootable DVD or a write-protected USB stick with Linux on it so that you have a guaranteed safe environment to boot into. We've got both of these, but we've never had to use them.



The question on everyone's lips: should you run antivirus programs in virtual machines?

You'd therefore have to conclude that you should protect each of your virtual machines as well. Virtual machines are just as vulnerable to infection as actual machines and since they have access to the internet, they can still spread viruses or get co-opted into botnets. Worse still, any antivirus running on the host machine won't protect your virtual machines. If you run lots of virtual machines simultaneously, make sure you stagger any disk scans, otherwise the actual hard disk will be crushed under the weight of all that virtual access.

HARDWARE

CPU OUT OF GAS?

Q I have an older laptop with a Pentium III 750 running Windows XP. I had been using it just for internet browsing until it started to slow down. It was taking forever to boot and opening any application became excruciating. I thought it may have been a virus or just crapware that I might have installed inadvertently, so I wiped the drive and did a fresh install of Windows XP. It didn't make much difference in speed so it made me wonder about the hardware, specifically the CPU. Do CPUs slow down over time and eventually stop working? I was always under the assumption that they either work or they don't.
Greg Whitlock

A If you're getting poor performance even after a clean install, it's more likely to be caused by a hardware problem than an OS issue. However, make sure you're not infecting the machine immediately after your clean install. We've seen a clean install immediately get infected upon connecting to the internet. Despite its age, Windows XP continues to be a top target of malware and putting an unpatched XP box on the internet without a firewall can result in nearly instantaneous infection. If your outbreak was severe enough, it may have infected

any portable drives you use, so you could be getting reinfected that way.

However, assuming your issue is purely hardware, CPUs don't get slower over time. They will execute the code as fast in 2013 as they did in 2001 – it's just that the code of 2013, written for more powerful hardware, may be far more taxing than the code of a decade ago. There are two problems we think might be responsible. The first is possible CPU throttling due to heat. The Pentium III doesn't have the advanced onboard thermal throttling of today's Core i7 chips. Instead, the chip counts on the chipset and motherboard to throttle back the clocks. If the laptop's fan is filled with dust or failed, the CPU may be throttling back in speed. The other possible issue is a failing hard drive, which may be generating enough random errors to affect performance.

PERIPHERALS

LOCKED USB KEY

Q I have a flash drive that I use for Xbox saves and taking class assignments to and from uni. The other day it suddenly flagged itself as read-only. The weird thing is that Windows Disk Management lists 'Current Read-only State: Yes', but then below that it says 'Read-only: No'. I know I can buy another 8GB drive, but what's up with this?

Leyton Parvo

When a USB deems itself as 'read-only', it's most likely down to a hardware fault.

A It's almost certainly a hardware fault. Some memory sticks are built using microSD cards glued onto a circuit board, instead of a flash RAM chip soldered on directly. The contacts for these can sometimes come loose and then the stick behaves erratically. If you've already copied the data off and you're resigned to buying a new stick, you can try cracking open the case to have a look. If it's the microSD type, you might be able to pull the card off and reuse it. That way you'll still have 8GB you can use in a card reader.

We've also seen situations where memory sticks formatted on an Xbox can look read-only on a PC. Reformat it on the Xbox to clear corrupted partition table entries.

HARDWARE

OVERHEATING SYSTEM

Q I have a PC I built in 2011 with an ASUS P8P67 motherboard, EVGA GeForce GTX 570 GPU, 3.4GHz Intel Core i7-2600K CPU and Cooler Master Hyper 212 Evo cooler. When playing *Battlefield 3*, I consistently get temperatures around 90°C. I'm pretty sure this is dangerous territory, though I've never had any problems – no crashes or anything. Still, this morning I took my cooler off and reapplied the thermal paste. I added a pea-sized drop of Arctic Silver 5 after thoroughly cleaning both the chip and the cooler. I plugged everything back in and got the same result. I have an older Lian Li case that has decent cooling. If I take the door off the machine it's very loud, but it does drop the temperature by about 10°. Still, 80° seems too high. Friends who play with me who have the same basic setup see temperatures more like 50°C and 60°C at load. My idle temp is around 40°. What am I doing wrong? What should I try? Should I worry about it or is 90°C OK?

Aaron Newton

A Yikes, that is high. It sounds like you're not getting enough airflow through your PC, or your CPU fan is fighting with your exhaust fan. Without a fresh supply of cool air and a quick way to exhaust the warm air, the ambient temperature in your case is going to stay high and even a great cooler isn't going to keep your rig cool.

Even with a good cooler, your PC case needs to have enough room for air to flow through.

Check that your intake fans are clean and free of dust, your fans are spinning and you have clear airflow from your front intakes to your rear exhaust fans. If you have fan mounts that aren't occupied, consider getting some high-airflow fans to put in them. If all that doesn't help, it may be time to invest in a new case – one that has ample cooling for today's components.

Finally, make sure the utility you're using is modern and reports the chip temps correctly. HWMonitor (**tinyurl.com/25xx66y**) works very well and will let you log the temps. We also recommend using Intel's own Turbo Boost Monitor to see what your chip is spooling up to as well. A chip that's stable yet excessively hot may not actually boost as high as it would if it were cooler.

CONTACT@APCTEST.COM Share your tech tips

Have you solved a tech problem or found a better way of doing things with your computer? Share your information with other APC readers by sending it in as a tip to contact@apctest.com, together with your name and contact details (details won't be printed). Alternatively, if you have a technical question, post it online on our forums at apcmag.com/forums and other readers may be able to solve it.

Get into Windows

Have you forgotten your Windows password? Jon Thompson explains how you can get in without it.

YOU'LL NEED THIS

WINDOWS 7 INSTALLATION DISC

Using the disc to 'repair' your installation gives you an opportunity to change the password.

OPHCRACK

In the event that you don't have an install disc, this password cracker can help you out. Get it from **ophcrack.sourceforge.net**.

Have you ever forgotten your Windows password and locked yourself out of your PC? It's a nightmare, but there are several ways to get back in, depending on the resources at your disposal. We're going to explore the method a professional hacker would use to get into your PC. It's straightforward and uses your Windows 7 installation disc, which contains all the tools you need to get in and change the password.

The technique we'll use contains a real-life hack. We'll replace the Sticky Keys executable with a command prompt, so that even without logging in, we can pull up a command line and change the password and then use it to log in. If you don't have a Windows installation disc, another option is to load up a password cracker. We'll show you how to do that using the industry-standard Ophcrack.

Remember, you should only use these techniques to access a computer that you own. Hacking into another person's machine is a criminal offence.

PERFORM THE WINDOWS REPAIR HACK

01 To reset your Windows user account password, you must first boot the computer from the Windows 7 installation disc. With the disc in your optical drive, power on your PC and when you're given the option to boot from DVD, quickly hit any key to boot. After Windows loads its installation files, you'll be shown the language setup page. Select your country to set up the keyboard and click the 'Next' button.

02 Click 'Repair your computer'. The repair software takes a few moments to load from the installation disc, then begins examining the computer's hard disk boot table, looking for any current Windows 7 installations to repair. Unless you've installed many copies of the operating system by hand, there will be just one installation (see image A), so click 'Next' to continue the recovery process.

03 The resulting screen gives you many options. Click 'Command Prompt' and one will appear. The C: drive usually isn't mounted as C at all. To find its current drive letter, type in `bcdedit | find "osdevice"`. This command results in text ending in `partition=` and a drive letter (see image B). This is the letter you should use instead of C in the following step.

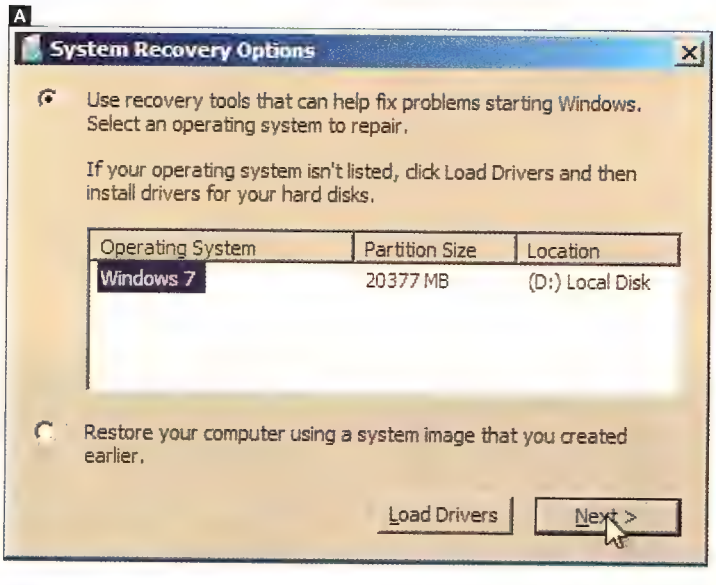
04 Enter the following commands. Take care to ensure that you use the correct driver letter in place of C: `copy c:\windows\system32\sethc.exe c:\` and then `copy c:\windows\system32\cmd.exe c:\windows\system32\sethc.exe`. When prompted, confirm the second command by typing `Yes`. The first command backs up a file and the second replaces it with the command prompt. As we mentioned earlier, what we're doing with this hack is replacing the Sticky Keys application with an executable for the command prompt. Since the Sticky Keys program can be launched at any time (even at the login screen), this will allow us to get command line access to the system without ever getting past the boot screen.

CHANGE THE PASSWORD USING THE COMMAND PROMPT

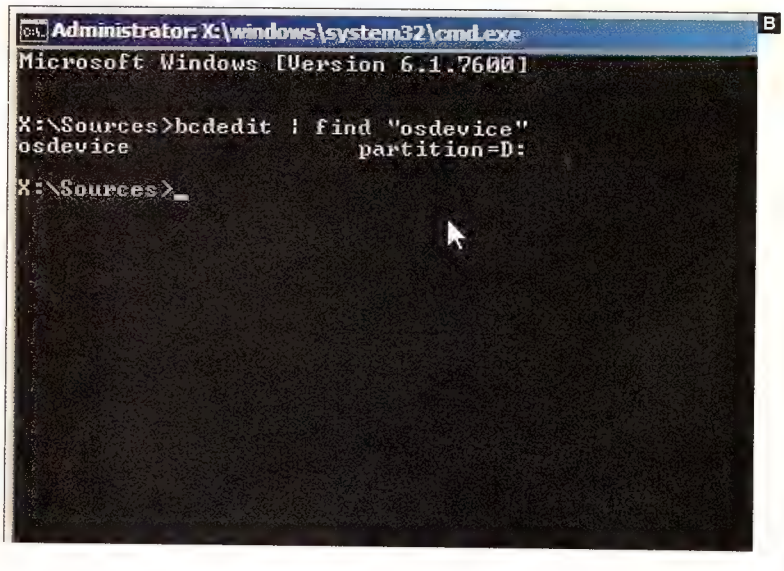
01 Remove the installation disc and reboot. On the login screen, press the Shift key five times in a row (the Sticky Keys hotkey). As if by magic, a command prompt will appear. Enter the following command: `net user <name> <new password>` (see image C). Substitute the name of the account to reset and a new password as appropriate. Close the command prompt and enter the new password to log in to your computer.

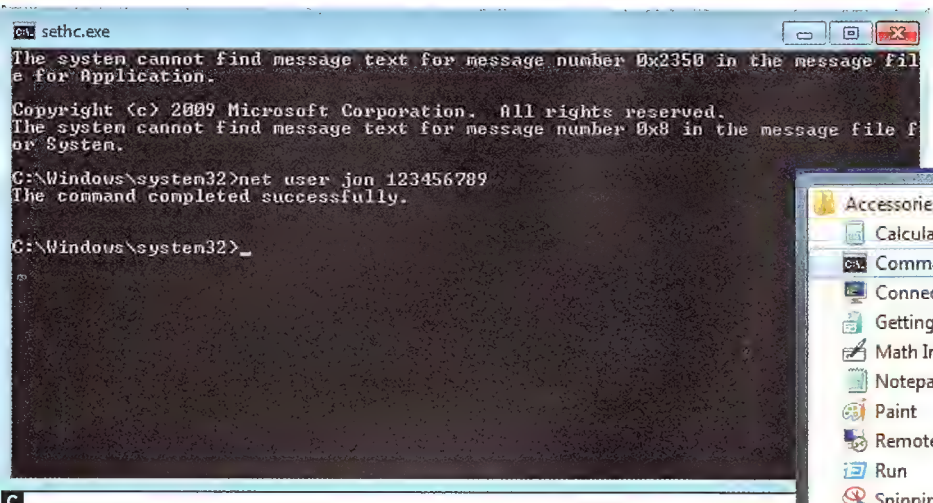
02 The final step we must take to gain access is to restore the sethc.exe file we overwrote in step 1. To do that, click 'Start > Accessories', right-click 'Command Prompt' and select 'Run as Administrator' (see image D). This gives you the right to copy 'sethc.exe' back into the 'system32' folder.

A


System Recovery Options
Use recovery tools that can help fix problems starting Windows.
Select an operating system to repair.
If your operating system isn't listed, click Load Drivers and then install drivers for your hard disks.
Operating System
Partition Size
Location
Windows 7
20377 MB
(D:) Local Disk
Restore your computer using a system image that you created earlier.
Load Drivers
Next >

B




sethc.exe
The system cannot find message text for message number 0x2350 in the message file for Application.
Copyright (c) 2009 Microsoft Corporation. All rights reserved.
The system cannot find message text for message number 0x8 in the message file for System.
C:\Windows\system32>net user jon 123456789
The command completed successfully.
C:\Windows\system32>_

C

Now enter the command copy c:\sethc.exe c:\windows\system32\sethc.exe . Confirm the copy to finish.

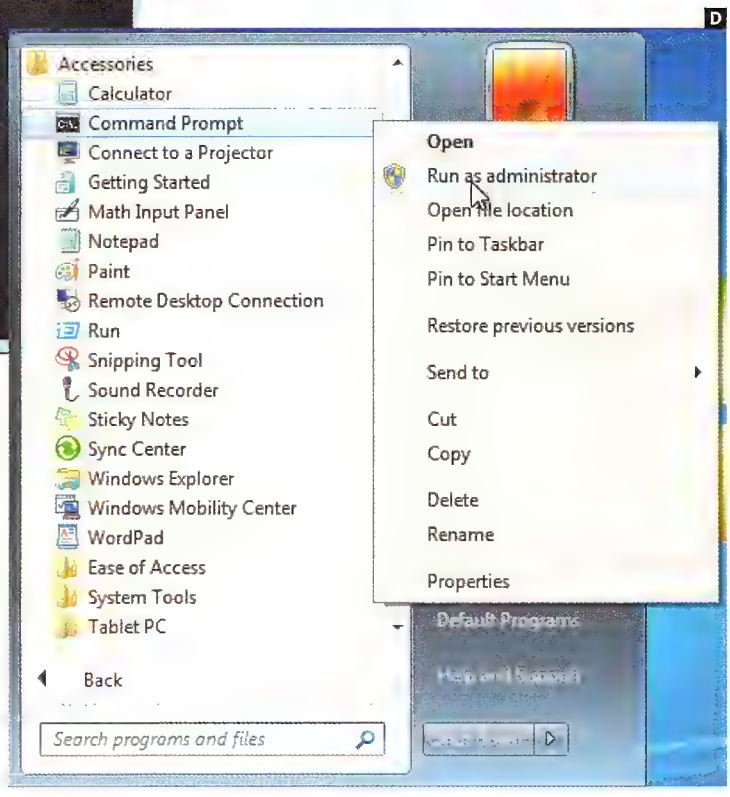
CRACK WITH OPHCRACK

01 To crack an unknown password, use a heavy-duty password cracker like Ophcrack (**ophcrack.sourceforge.net**). Insert a blank, formatted DVD-RW, right-click the downloaded image and select 'Burn disc image'. The disc being written is a bootable live CD with Linux and Ophcrack.

02 Once the DVD has been written, boot the affected computer and the DVD should begin to automatically load the Ophcrack software, which runs outside of Windows. Once that's done, a menu should appear offering several options for running Ophcrack (see image E). Either press Enter, or wait for the timeout and automatically select the 'Ophcrack graphic mode'.

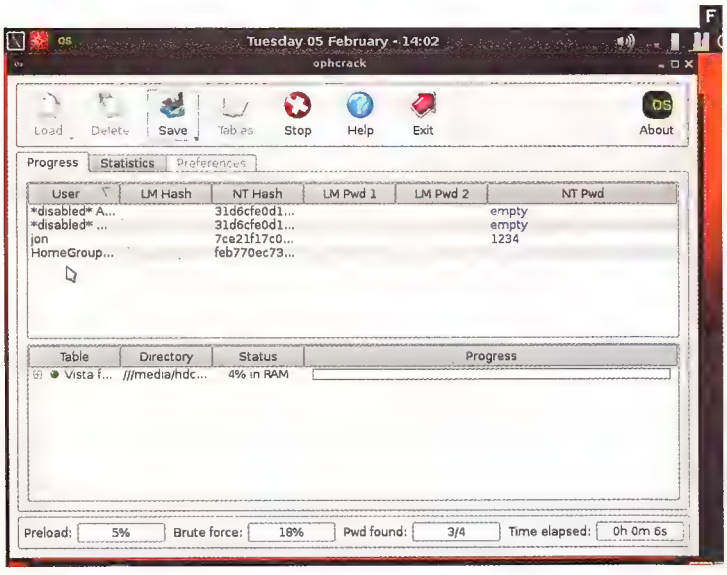
03 Short passwords such as '1234' or 'password' will fall to Ophcrack almost immediately because the software tries these first in a brute-force attack. Complex passwords take more time and the longer the password, the longer it will take to crack – if it can be cracked at all. A complex password may take several hours to crack. If Ophcrack uncovers the password, it will be displayed in the 'NT Pwd' column (see image F). Ophcrack doesn't store the passwords, so make a note of it.

04 Finally, you can perform a deep scan of the whole computer to reveal all passwords associated with the Windows user accounts. Close any windows and double-click 'Launcher'. Scroll down to 'DeepSearch' (see image G) and press Enter. Ophcrack will search all available media – not just the system volume – for any password files and then perform its cracking wizardry.



D

E



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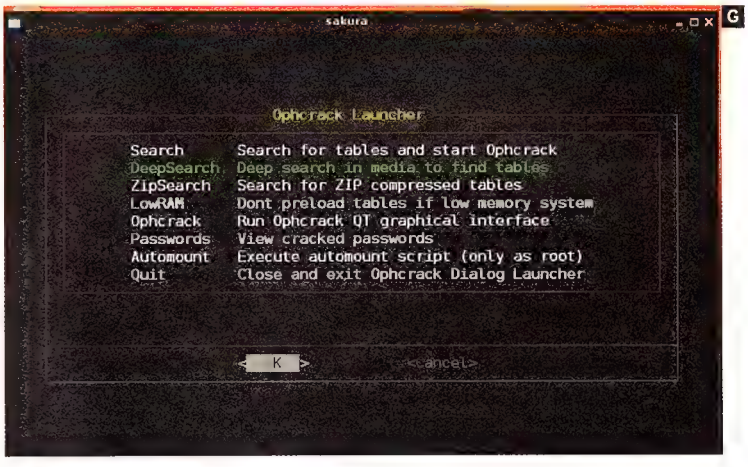


G

Dealing with displays

When it comes to monitors, more than one is almost always better. Beyond the expanded screen real estate for working, gaming across multiple monitors is a beauty to behold. Ashton Mills explains.

YOU'LL NEED THIS

SOFTTH
Download the program from **www.kegetys.fi/SoftTH**.

FLAWLESS WIDESCREEN
Download the program from **tinyurl.com/ox5pmlv**.

WIDESCREEN FIXER
Download the program from **www.widescreenfixer.org**.

It's never quite as simple as the dream. Nvidia's Surround and AMD's Eyefinity have their problems and even when these work, there can be issues with HUD placement being out of place or the field of vision being woefully inadequate. Not to mention the limitations Surround and Eyefinity impose with both graphics cards and the monitors used.

Fortunately, there are some helpful tools you can use to not only get your games running across multiple monitors, but ensuring they look great, too. As is often the way, the benefits filter down to single-display users as well.

So if you enjoy your gaming, take a look at these three brilliant programs you can use to take it to the next level.

SOFTTH

www.kegetys.fi/SoftTH

Without a doubt, SoftTH is impressive. In essence, it's a software implementation of multi-monitor gaming (hence Soft TripleHead as its title), independent of either Nvidia Surround or AMD Eyefinity technology.

It can take multiple monitors – even of different sizes and resolutions – and span a game or other software across all the monitors as a single display. This is pretty damn nifty when you think about it, considering the otherwise proprietary implementations required by Nvidia and AMD.

However, it's not all roses and flaming death to your onscreen enemies. As the name implies, it's a software implementation and it works differently to the solutions by the big boys in team Green and Red; namely, a single card does the rendering for the whole display, whereas Nvidia Surround and AMD Eyefinity can use multiple cards in SLI or CrossFire to distribute the load. Note that you can still use multiple video cards to output, which in some cases is required depending on what video cards you have, in order to hook up multiple monitors.

Still, it's an impressive piece of software that works by first rendering the game at the desired multi-monitor resolution and then splitting the resultant image into a number of frames. The middle frame is sent to the middle monitor, while the other frames destined for other displays are sent to main memory and then onto other video cards to display on their respective monitors.

While SoftTH is slower than using a Surround or Eyefinity setup, it has a number of advantages over these systems. It can use more than three monitors, these monitors can be of different sizes and resolutions, and you can mix and match video cards to power the displays; for example, powering a main display with a GeForce GT670 card from Nvidia while using a much older generation card like the 8800GTS to power the other displays. You can even combine cards from both Nvidia and AMD – since rendering is done on the primary card only, any video can be used to output frames on alternate connected monitors.

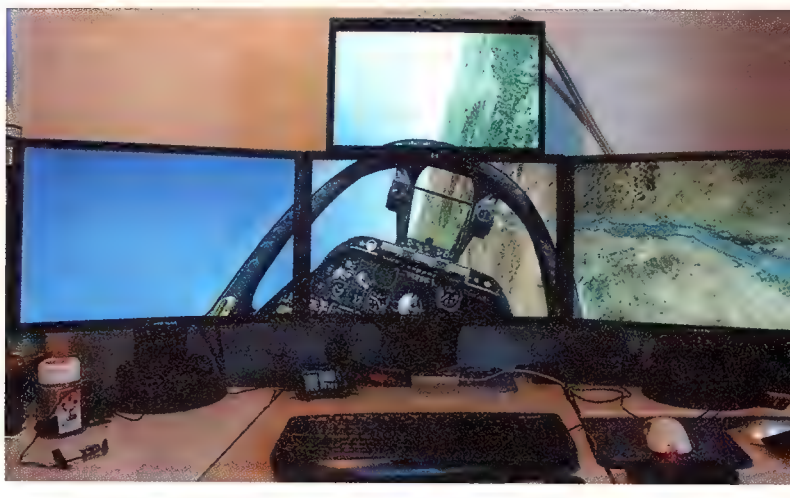
Technically, it could also be used to set up a PLP (Portrait-Landscape-Portrait) display, something that can't be done with Nvidia or AMD's solutions. For many multi-monitor aficionados, this is considered the ultimate: a large central display with small portrait-orientated displays on either side, thereby keeping immersion-breaking monitor bezels further out of your field of vision.

In fact, SoftTH is unique in the sense that you can also render a display beyond the size of your monitors. This can be useful if you're using different-sized monitors or in configurations beyond 3x1, for example. SoftTH has actually been around for quite some time and was initially made popular by racing and flight sim fans who wanted to expand their field of view for a more immersive experience.

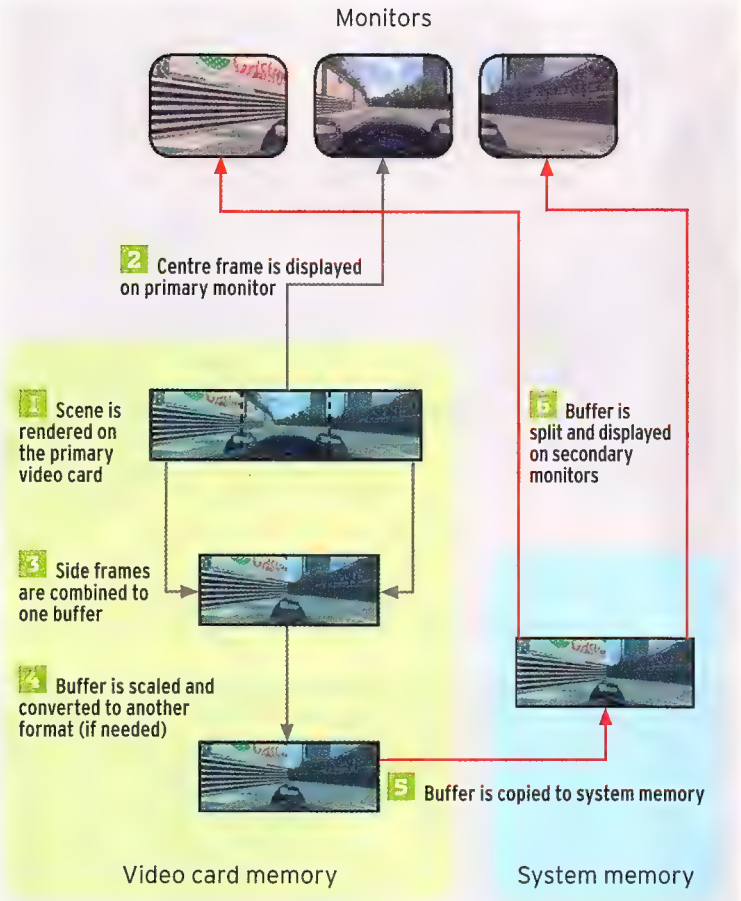
To that end, it works well for most popular simulation games; however, there is one caveat: SoftTH only works with DirectX 9 titles. Fortunately, DirectX 10 and 11 games are still only gaining traction today, with most current games being Direct 9 including blockbusters like *Skyrim* and *Mass Effect 3*.

Setting up SoftTH is easy, too: it works as a DLL file injection much like the ENB or SweetFX tools (which we've previously covered) to enhance games with antialiasing and other effects. Installing it is just a matter of copying the 'd3d9.dll' file to the binaries folder of the game of your choice and launching the game. The first time you do so, you'll be prompted to create a new configuration file. Doing so places a file called 'config.SoftTHconfig' in the same directory where you placed the DLL file and is easily editable in a text editor.

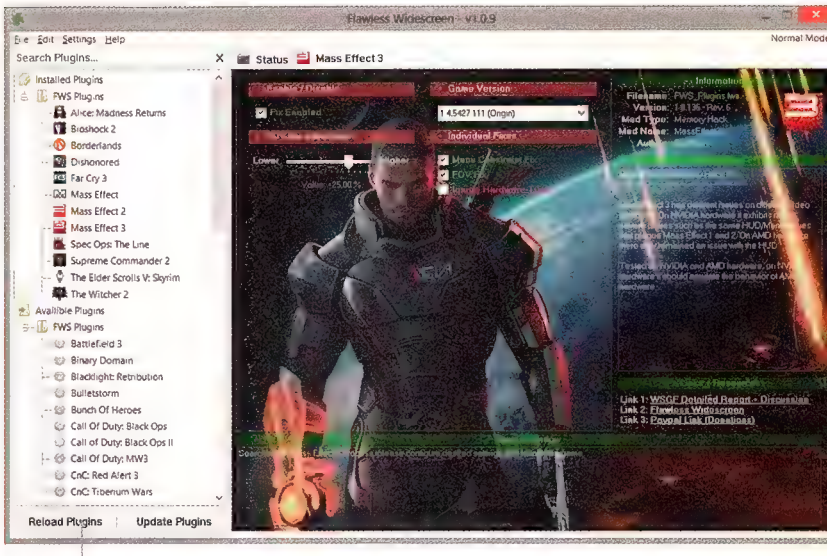
This is important, as you'll need to then edit the file and configure your desired resolution and the number of displays if it's not correct. Then, it's just a matter of selecting the new resolution in the game, which the replacement DLL file conveniently supplies.



Unlike Nvidia and AMD's solutions, different monitors in different setups can be used with SoftTH.

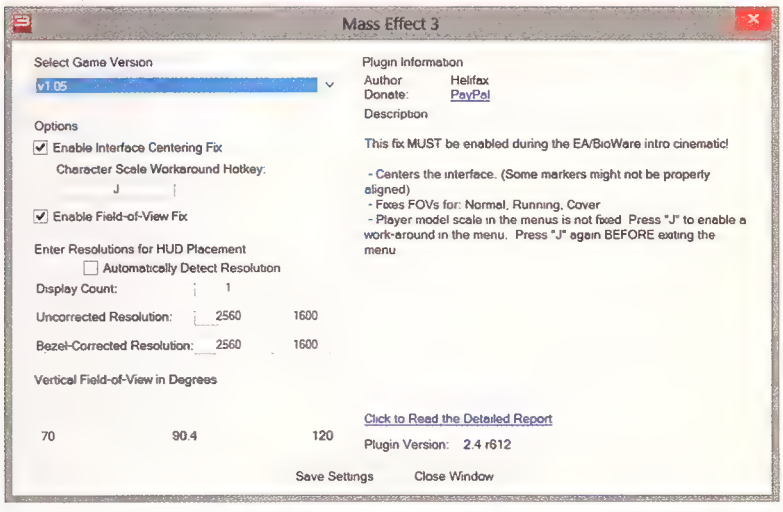

Monitors
2 Centre frame is displayed on primary monitor
1 Scene is rendered on the primary video card
3 Side frames are combined to one buffer
4 Buffer is scaled and converted to another format (if needed)
5 Buffer is copied to system memory
5 Buffer is split and displayed on secondary monitors
Video card memory
System memory

SoftTH enables multi-screen gaming through the clever use of frame buffers.



Flawless Widescreen makes it easy to correct FOV and apply other widescreen fixes for multi-monitor and widescreen gaming.

Widescreen Fixer isn't as pretty as Flawless Widescreen, but it's more up-to-date with the latest titles.


Mass Effect 3
Select Game Version
v1.05
Plugin Information
Author Helifax
Donate: PayPal
Description
Options
Enable Interface Centering Fix
Character Scale Workaround Hotkey:
J
Enable Field-of-View Fix
Enter Resolutions for HUD Placement
Automatically Detect Resolution
Display Count: 1
Uncorrected Resolution: 2560 1600
Bezel-Corrected Resolution: 2560 1600
Vertical Field-of-View in Degrees
70 90.4 120
This fix MUST be enabled during the EA/BioWare intro cinematic!
- Centers the interface. (Some markers might not be properly aligned)
- Fixes FOVs for: Normal, Running, Cover
- Player model scale in the menus is not fixed. Press "J" to enable a work-around in the menu. Press "J" again BEFORE exiting the menu
Click to Read the Detailed Report
Plugin Version: 2.4 r612
Save Settings
Close Window

You'll note a number of settings in the configuration file that you can set, from 'vsync' and 'frame rate' limiting to various fixes and workarounds – it's essential to read the 'Readme' file to understand what you need to set and when.

Finally, note that as a DLL injector, it's essentially incompatible with other injectors like SweetFX or ENB unless you chain-load them. SoftTH supports chain-loading another 'd3d9.dll' file after it, as does ENB, but SweetFX doesn't at this time so if you use SweetFX, you'll want to chain-load it from SoftTH. And given that SoftTH is providing the full-size frame buffer that SweetFX would operate on, this is generally a good idea.

Recently, SoftTH was released as open source to encourage ongoing development. Check out the thread here (**tinyurl.com/o3sbmkk**) if you want to get involved.

FLAWLESS WIDESCREEN

tinyurl.com/ox5pmlv

While SoftTH is a method for spanning games across displays, Flawless Widescreen is a useful tool to get them running, well, flawlessly. Because multi-monitor gaming is still in its infancy, invariably running games across multiple monitors tends to cause certain artefacts.

Usually, this involves issues with the game's HUD (heads-up display) not working well (for example, being centred on the main screen and not spanned across all three monitors), aspect ratio problems in menus or most frequently, incorrect FOV (field of vision). Inherently, the FOV of most games is tailored to a single monitor, which when expanded across multiple displays often creates a 'fishbowl' effect that can be seriously disorientating.

It's worth noting this can happen even if you're using Nvidia's Surround or AMD's Eyefinity – it's not a function of the technology, but the game not being designed to run this way. Unfortunately, this includes pretty much every title ever made, so until multi-monitor gaming becomes the norm, fixes are needed to correct the FOV to appropriately accommodate the expanded field of view that multiple monitors provides.

Some games – the good ones – have a field of view setting. This is useful even on single monitors for those who feel the game's default FOV is 'cramped' when playing. Many games don't provide this, though, and so tools like Flawless Widescreen exist to correct this.

And an impressive tool it is: if a game doesn't support altering the FOV and its publishers don't exactly release their source code, Flawless Widescreen works its magic by fixing the game in-memory after it's loaded, basically altering the binary on the fly. It works rather well, although it's dependent on users creating plug-in files not just for every game, but every version of every game. That's because each time a new patch is released, the contents of the binary executable change and hence so do the addresses at which the FOV fix needs to be injected.

Flawless Widescreen at least makes it easy to use: simply click on

the game title under 'FWS plugins' and the plug-in will be installed. Go to the settings page to set your expanded FOV and enable any other fixes that may have been supplied, and then simply launch your game. As long as Flawless Widescreen is running, it will detect when the game loads and patch it in real-time in memory.

The plug-ins are reasonably up-to-date; for example, you'll find plug-ins for *Dishonored* and *Far Cry 3*, while also supporting classics like *Skyrim* and the *Mass Effect* series. The plug-ins themselves are in LUA script, so if you know what you're doing, you can edit these directly either to alter the options presented or (if you're a bit of programmer and a new game version is released) to change the address at which the fixes are injected.

While Flawless Widescreen makes it easy to adjust the FOV for Nvidia Surround and AMD Eyefinity displays, it also supports SoftTH and again, it's rather helpful even if you use a single display. See the example *Mass Effect 3* shots at right for an example.

It's hard to overstate how important a correct FOV is to gaming: some people get headaches or eye strain from incorrect FOV, largely because many developers still use 4:3 as a screen ratio rather than the now-standard 16:9 – many games tend to set a FOV at 70°, but 90° is the ideal for a widescreen monitor. It's hard to explain the difference correct FOV has on gameplay: the first time you load the game after altering the FOV and running around feels like a breath of fresh air. It's hard to accurately describe, but opening up the FOV opens your spatial awareness and it *feels* so much better.

Flawless Widescreen has actually been around in one form or another for many years, initially starting out as a small project for users on the WideScreen Gaming Forums (**www.wsgf.org**). However, the author, HaYDeN, has since set up a dedicated web site and continues to develop it.

If you have a game that does support changing FOV and you're on a widescreen monitor, try increasing it to see. For games that don't support this, Flawless Widescreen is there to save you.

Even for single-screen gaming, the FOV fixes Flawless Widescreen and Widescreen Fixer allow for a more comfortable view. Here, the expanded FOV allows us to see more of Shepard from *Mass Effect 3*, as well as the environment around her.

WIDESCREEN FIXER

www.widescreenfixer.org

Widescreen Fixer aims to fulfil the same role as Flawless Widescreen and also uses an injection method for altering the FOV and implementing other widescreen fixes like the positioning of the HUD. The interface isn't quite as nice – nor as intuitive – as Flawless Widescreen and it also requires manual activation once a game has loaded by hitting the (*) key on your keypad. However, its plug-in modules are more up-to-date, so if you find a game or game version unsupported in Flawless Widescreen, Widescreen Fixer may suffice.

Like Flawless Widescreen, Widescreen Fixer can be used to properly set the FOV in a game and toggle other fixes by using hotkeys that can be set in a plug-in's configuration; for example, centring models in a character select screen or repositioning menu text.

By default, most plug-ins will try to auto-detect your monitor configuration, but you can also manually force how many monitors you have and in what resolution they span. This is useful if you're running a single display and just want to take advantage of the FOV alteration – simply deselect the 'auto-detect' option and then manually input a single monitor and the resolution to match. That said, not every game's plug-in supports changing the FOV – many seem geared towards providing a proper aspect ratio and HUD placement for multi-monitor configurations.

Also working slightly against it is that all plug-ins come as DLL files, which means you're reliant on the author to update and provide new compiled DLL modules.

However, as it supports a wider range of games than Flawless Widescreen and plug-ins for these are more up-to-date with the latest versions of games, if Flawless Widescreen doesn't help, give Widescreen Fixer a go. APC

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Raring up the tweaks

Raring Ringtail, otherwise known as Ubuntu 13.04, is out in the wild and with it came a fresh lick of paint, some under-the-bonnet performance improvements and a bevy of new features. Ashton Mills explains.

YOU'LL NEED THIS

UBUNTU 13.04

For the latest features, download Raring Ringtail from **www.ubuntu.com/download**.

UBUNTU TWEAK

Head to **ubuntu-tweak.com** to download it.

While the default configuration of a new Ubuntu 13.04 install is spanky out of the box, it's not to say you can't improve it or tweak it to your preferences. However, there's only so much you can do with Ubuntu's default configuration tools found under 'System Settings' and you may be left wanting. Indeed, there's quite a lot more that you can tailor and tweak in Ubuntu that isn't directly exposed via the standard tools.

Which is where, of course, some third-party programs can come to the rescue. It's been a while since we looked at tweaking Ubuntu and since Linux users love choice, it's no surprise that there's now an excellent tweaking tool in Ubuntu's own repositories just *raring* to go (we apologise for that one).

UNITY TWEAK TOOL

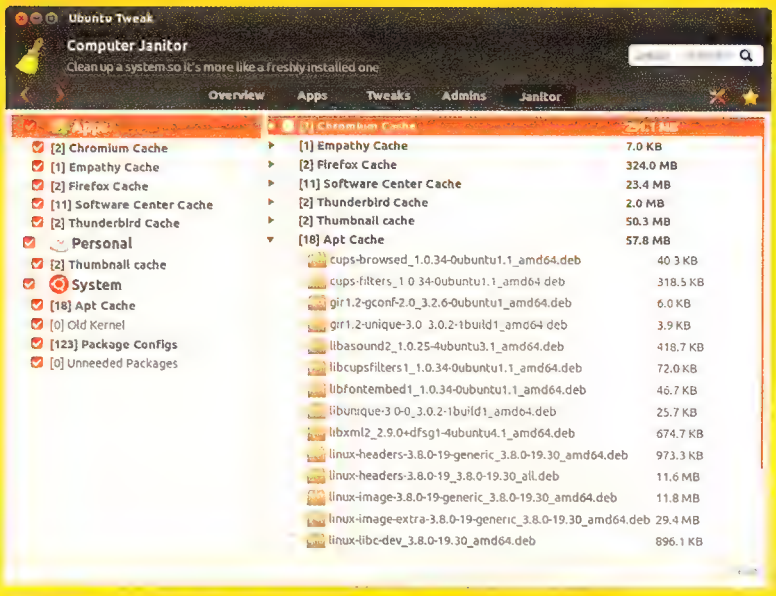
Canonical's Unity interface has matured nicely over the last few Ubuntu releases, but if there's a common complaint it's that it happens to be a tad inflexible in how it's configured. The Unity features you can tweak in the 'Appearance' dialogue in 'System Settings' are limited to setting the launcher icon size, if the Unity bar auto-hides, and... well, no, that's about it.

Fortunately, you don't need to go digging into the gconf-editor – Ubuntu's equivalent of the Windows registry – to change more settings. Instead, there's an app for that: the Unity Tweak Tool.

You can find it in the 'Software Center' by searching for `Unity Tweak` or you can commando it at the command line with a simple `sudo apt-get install unity-tweak-tool` . Once installed, hit up the Dash and simply type in `Unity` to find it.

You'll note that it's laid out similar to the 'System Settings' panel and provides four areas to tweak: 'Unity', the 'Window Manager', 'Appearance' and 'System'.

Here are some of the highlights of what you can do.



Clean out system crud with Ubuntu Tweak's handy Janitor tool.

Unity: Set transparency for the Unity bar, as well as whether it appears on all or only one desktop (great for multi-monitor configurations); tailor the animations used for launchers; set how and when icons such as 'Power' and 'Bluetooth' appear in the panel and whether the panel itself is transparent; keyboard binds for various shortcuts ('Expose', 'Switcher' et al); and importantly, enable, disable and select which sources are used for online searching in the Dash, if you're concerned about privacy.

Window Manager: Set the texture quality and whether Vsync is respected for graphical updates; determine if 'Workspaces' are used and how many; tailor how 'Window Snapping' works (maximising or half-screening programs if they're dragged to specific edges); whether you want to use 'Hot Corners' and what function each corner activates; 'Focus' and 'Titlebar Actions' for manipulating program windows; and toggling animation styles and shortcut keys.

Appearance: Gives you much more control over the default Ubuntu themes beyond the ability to simply select one as in the 'System Settings' panel. Here you can mix and match icon themes, cursors and fonts with a given theme selected. You can also tailor the layout of window buttons ('Close', 'Maximize' and so on) and if you want them right- or left-aligned (remember when 'Close' used to be on the far right?).

System: Set whether icons such as the 'Home Folder', 'Network', 'Rubbish Bin' and 'Devices' appear on the desktop; set basic security features to prevent printing or desktop locking, and toggle the behaviour of the 'Overlay Scrollbars' – the Unity feature that did away with scrollbars to be replaced with a slideable tab that appears only when the edge is highlighted. Set it to 'Legacy' if you prefer the classic style.

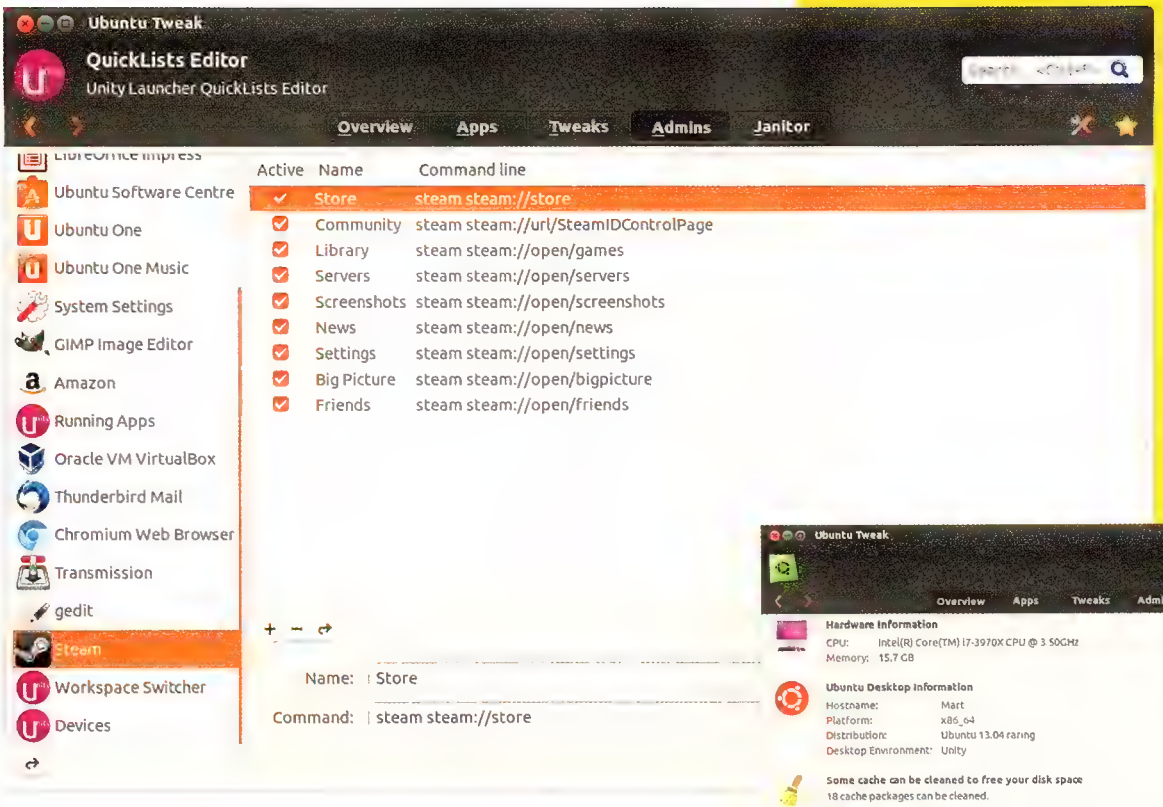
UBUNTU TWEAK

This is the perhaps the quintessential tweak tool for Ubuntu, but it needs to be updated with each new release to properly support changes as Ubuntu evolves. Raring Ringtail support has just been added, so now is a great time to dive in with this handy tool if you haven't used it before.

Ubuntu Tweak can't be found in the Ubuntu repositories, but installing it is easy – just head to **ubuntu-tweak.com** and click on the 'Download now!' button, which will save a '.deb' file. Double-clicking this will launch the 'Software Center' and install it for you.

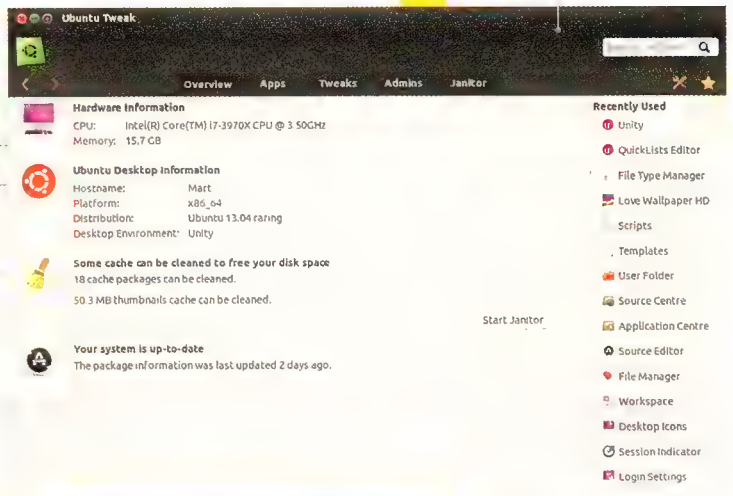
Ubuntu Tweak has a number of features for you to play with, including its own Unity tweaks, some of which can't be found in the Unity Tweak Tool. Primarily, though, Ubuntu Tweak has a few key sections.

Apps: This is a predefined list of common, useful as well as (sometimes) little-known programs that may or may not be



Take advantage of one of Unity's most powerful functions and edit the 'Quicklists' for your applications.

Unity Tweak is a simple and comprehensive tool for tweaking Ubuntu's Unity interface.



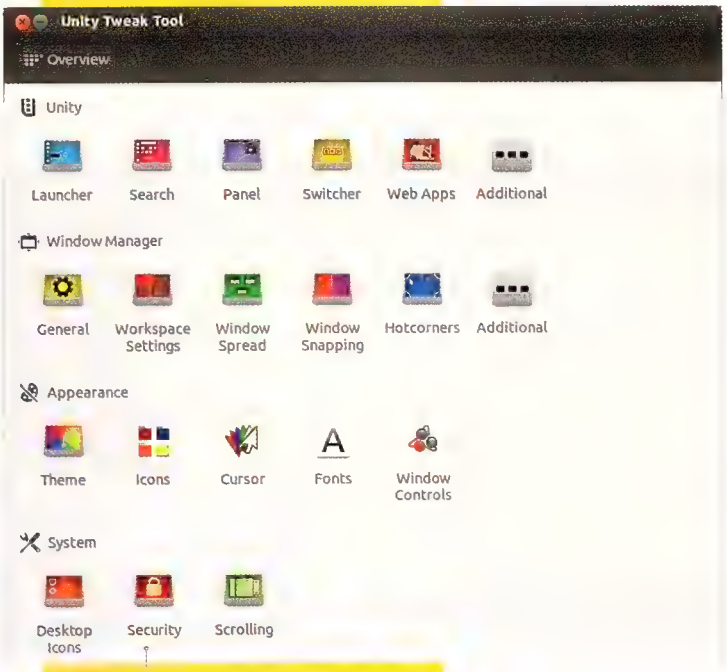
in the Ubuntu repositories. Think of it like a little app store of some of the best software you might want to use. There are 15 sections to browse and installing apps is as simple as clicking on them – if a program doesn't belong in the official Ubuntu repositories, the source repository for the app will be added for you before downloading. Some great apps here include Google Earth, Skype, Opera, Cairo-Dock, Deluge, FileZilla and 7-Zip. Note that some of the third-party repositories may not have packages for Ubuntu 13.04 yet, in which case Ubuntu Tweak won't be able to install them.

Tweaks: Some of the tweaks here can also be found in the Unity Tweak Tool, but there are many more here, including the ability to tailor Ubuntu 13.04's login screens (theme, logo, background and so on); basic settings for the sound theme; Unity tweaks that include the ability to set the size of the Dash; file manager tweaks for the location bar and media mount options; and a wallpaper browser that pulls wallpapers from the net among other tweaks.

Admins: This section lets you edit Ubuntu's source repositories easily, as well as add new sources for third-party programs. When first clicking on 'Source Center' or 'Application Center' be sure to click 'Sync' in the bottom-right to allow Ubuntu Tweak to fetch the most up-to-date lists for sources. Then you can browse and add sources by simply selecting them. For example, if you want to receive updates for Ubuntu Tweak, click on 'Utility' in the left and enable the 'Ubuntu Tweak Stable PPA' source.

The 'Admins' section also gives you fine control over file templates, file type associations and file manager scripts but perhaps its most useful feature is the Unity 'Quicklist Editor' – you know how if you right-click on a program in the Unity launcher you see app-specific functions (for example, 'Compose New Message' for Thunderbird)? This lets you add, remove or edit these functions for every program in your launcher. Awesome.

Janitor: Finally there's the Janitor, perhaps the closest thing Ubuntu has to Crap Cleaner under Windows. The Janitor will scan your system and let you know about caches to clear, old kernels to remove and other gunk that may be cluttering your system. It's not quite as extensive as programs like BleachBit to remove crud, but it has a nicer interface.



Recently updated for Raring Ringtail, Ubuntu Tweak is an excellent, all-round tweaking program.

Rescue space urgently

Running out of space on your hard drive can be disastrous and you don't always have time to do a proper spring clean. Matthew J.C. Powell shows a few tricks for freeing up space fast.

YOU'LL NEED THIS

FINDER

All of these very simple tasks in this tutorial can be accomplished with Finder. No other software is required.

Your hard drive never seems to pick a good moment to run out of space – not that there's ever a good moment for such a thing. It's never while you're idly fiddling about with things that you can stop for a while so you can sort through iPhoto and delete all the photos of sandwiches. No, it's always when you've almost finished a huge project that you no longer have enough space to save. Time to panic? Yes, a little bit. But when you're done, try this.

EMPTY THE TRASH

As you're no doubt aware, when you move an item to the Trash in OS X, it isn't deleted straight away. It sits on your hard drive waiting to be properly deleted when you empty the Trash (in the Finder, go to the 'Finder' menu and select 'Empty Trash', or right-click the 'Trash' icon in the Dock).

If you're a reasonably experienced Mac user, you probably think you're a pretty conscientious Trash manager, right? When you put things in the Trash, you then empty it straight away or at worst, leave it a day or two, to be sure you really don't need that stuff anymore. OK, a week maybe. Ish.

What about all the stuff in the Trash that you didn't put there? For instance, what about all the old versions of iPhone apps that you've updated? I'll bet you didn't know they don't get automatically deleted or overwritten. In fact, they're just moved to the Trash, waiting for you to empty it. There can be lots of them and they can be big – as I write this, there's 16GB of stuff in my Trash waiting to be deleted, and most of it's iOS apps. A simple click of 'Empty Trash' can mean the difference between a full drive and a usable one.

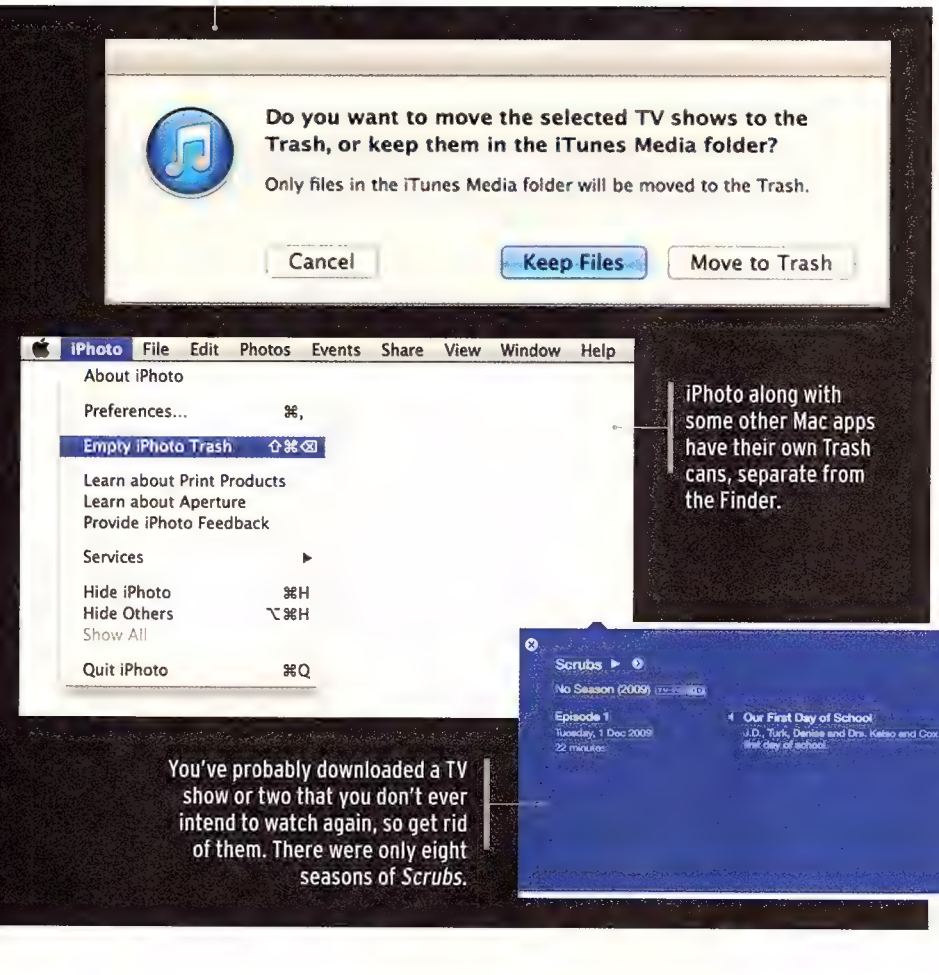
But wait, there's more. You see, the Finder is only one of the applications on your Mac that has a Trash can. If you regularly delete photos in iPhoto or messages in Mail, you'll find that each of those applications also has its own Trash, separate from the Finder's. So does iMovie and there are a bunch of others.

In iPhoto and most other apps with their own Trash, the 'Empty Trash' command is found in a similar place to where it's located in the Finder: under the 'Application' menu. ('Application menu' is the generic term for the menu in any OS X application that bears the name of the application. So in iPhoto, the 'Application' menu is the one that reads 'iPhoto' and so on.) Click on the name of the application and you'll see a command like 'Empty iPhoto Trash' in the menu.

In Mail it's a little more confusing because each account that you set up has its own 'Deleted Items' folder, which is essentially a Trash can. Click on the 'Mailbox' menu and then 'Empty Deleted Items'. You can choose to empty the 'Deleted Items' folder for only one account, or all of them at once.

Speaking of accounts, if you have multiple user accounts on your Mac, it's worth noting that each user has their own Trash can. If space is at a premium, ask every user of your Mac to 'Empty the Trash' from time to time.

Deleting items from your iTunes library doesn't necessarily remove them from your hard drive. Make sure you move them to the Trash (and empty it) if you want them *really* gone.



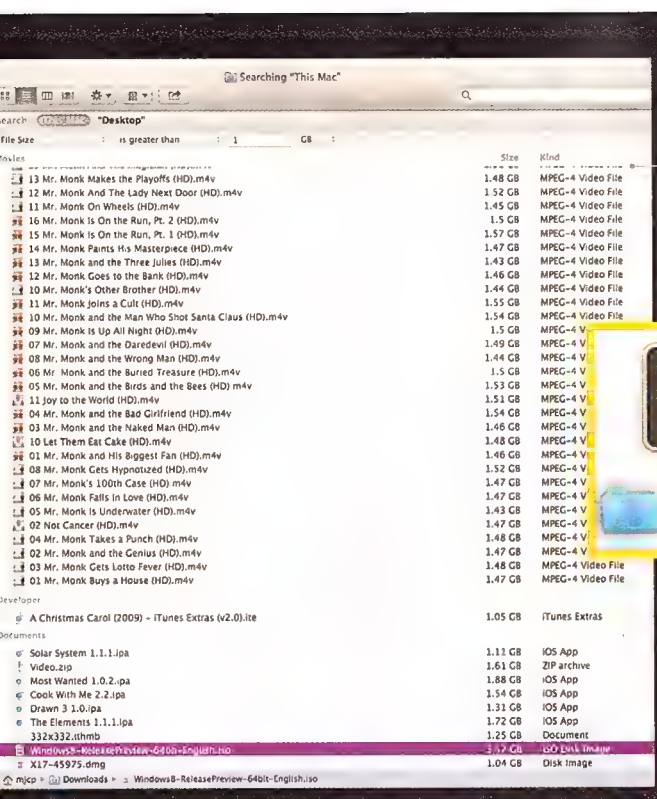
iPhoto along with some other Mac apps have their own Trash cans, separate from the Finder.

You've probably downloaded a TV show or two that you don't ever intend to watch again, so get rid of them. There were only eight seasons of *Scrubs*.

STILL NEED MORE SPACE?

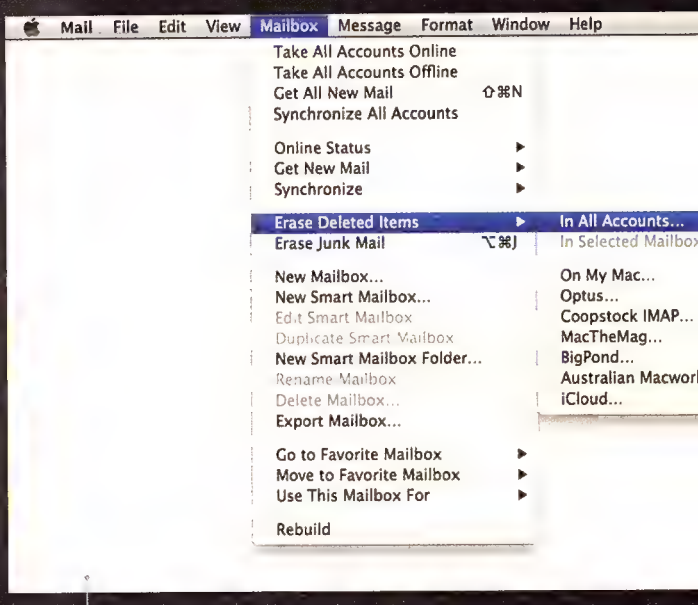
Emptying the Trash(es) will usually free up some much-needed space in a hurry, but there could still be some very big files lurking around your hard drive taking up space you need for other things.

To find out what the biggest things are on your hard drive, press Command-F. That's the 'Find' command. A window will open that looks much like any other Finder window, except this one has 'Search' at the top of it and drop-downs for search criteria. Click on the button that says 'Kind' and then select 'File Size' from the menu. If 'File Size' isn't already in the menu, select 'Other', scroll down the list to 'File Size' and click on it. You might like to check the box for 'In Menu' to add it to the drop-down list, so you can speed up future searches.



The 'Find' command and skilful use of 'Arrange By' can help you locate the space hogs on your hard drive fast.

Right-click (or two-finger tap on a trackpad) on the 'Trash' icon in the Dock to empty it.



When you delete messages in Mail, they're not really deleted. They're kept in 'Deleted Items' folders, in case you want them again. This is Apple's very special meaning of the word 'deleted'.

Then, click on the button that says 'equals' and select 'is greater than'. Finally, click on the button that says 'KB', select 'GB' and enter a value in the text field; say, 1. That will list all the files on your Mac that are greater than 1GB in size. It's really important that you change 'KB' to 'GB' before you type the 1, otherwise your Mac will then buzz and whirr for ages listing everything larger than a kilobyte on the drive. Ain't nobody got time for that.

The files may not be in any particular order at this point, so to sort them out, click on the task button (it looks like a little gear) and select 'Arrange By > Kind'. That will separate applications from movies, PDFs, documents and so on. If you want even more guidance, click on the 'Size' column heading and the files will be sorted by size, but still arranged by category. If there isn't a 'Size' column, right-click in the column headers to add one.

Now you can see the largest files on your hard drive, sorted by size and arranged by kind. Chances are you'll find an app you no longer use, a TV show you downloaded but don't want to watch again, or (more than likely) ZIP and DMG files you've downloaded and no longer require. Zap them.

Speaking of downloads, when was the last time you looked in your 'Downloads' folder? It can be a scary place. All the installers, archives, disk images and so on that you download go in there, probably assuming you'll put it somewhere sensible eventually. Of course, you won't – it's in a folder, out of the way, so that will do.

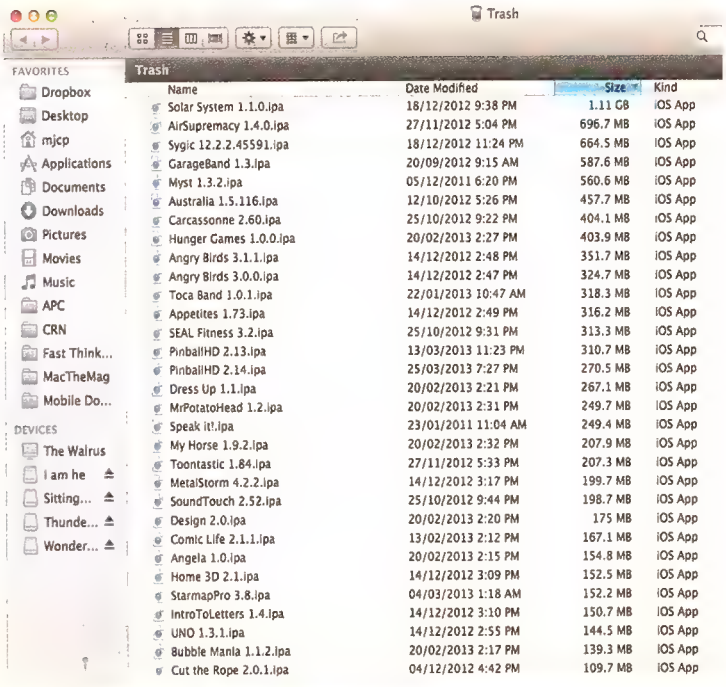
My 'Downloads' folder, as I write this, contains over 96GB of stuff. Some of it I want, most of it I don't. The top 10 largest items total over 30GB and I don't need any of them. Go check your 'Downloads' folder and you may find you're in a similar boat.

WHEN YOU GET TIME

The above are quick fixes for getting emergency space fast, but there's more you can do. We'll explore some more advanced housekeeping tasks in future articles.

For now, we'll offer a tip. Move your iTunes and iPhoto libraries off your startup disk and put them on external drives. For one thing, it makes them safer, since corruption on your startup disk won't damage these valuable resources. For another, it makes them easier to back up, since you can simply clone them to other drives.

Best of all, it opens up vast swathes of your startup disk. Ah, the wide open spaces.


Trash
FAVORITES
Dropbox
Desktop
mjcp
Applications
Documents
Downloads
Pictures
Movies
Music
APC
CRN
Fast Think...
MacTheMag
Mobile Do...
DEVICES
The Walrus
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Solar System 1.1.0.ipa 18/12/2012 9:38 PM 1.11 GB iOS App
AirSupremacy 1.4.0.ipa 27/11/2012 5:04 PM 696.7 MB iOS App
Sygic 12.2.2.45591.ipa 18/12/2012 11:24 PM 664.5 MB iOS App
GarageBand 1.3.ipa 20/09/2012 9:15 AM 587.6 MB iOS App
Myst 1.3.2.ipa 05/12/2011 6:20 PM 560.6 MB iOS App
Australia 1.5.116.ipa 12/10/2012 5:26 PM 457.7 MB iOS App
Carcassonne 2.60.ipa 25/10/2012 9:22 PM 404.1 MB iOS App
Hunger Games 1.0.0.ipa 20/02/2013 2:27 PM 403.9 MB iOS App
Angry Birds 3.1.1.ipa 14/12/2012 2:48 PM 351.7 MB iOS App
Angry Birds 3.0.0.ipa 14/12/2012 2:47 PM 324.7 MB iOS App
Toca Band 1.0.1.ipa 22/01/2013 10:47 AM 318.3 MB iOS App
Appetites 1.73.ipa 14/12/2012 2:49 PM 316.2 MB iOS App
SEAL Fitness 3.2.ipa 25/10/2012 9:31 PM 313.3 MB iOS App
PinballHD 2.13.ipa 13/03/2013 11:23 PM 310.7 MB iOS App
PinballHD 2.14.ipa 25/03/2013 7:27 PM 270.5 MB iOS App
Dress Up 1.1.ipa 20/02/2013 2:21 PM 267.1 MB iOS App
MrPotatoHead 1.2.ipa 20/02/2013 2:31 PM 249.7 MB iOS App
Speak it!.ipa 23/01/2011 11:04 AM 249.4 MB iOS App
My Horse 1.9.2.ipa 20/02/2013 2:32 PM 207.9 MB iOS App
Toontastic 1.84.ipa 27/11/2012 5:33 PM 207.3 MB iOS App
MetalStorm 4.2.2.ipa 14/12/2012 3:17 PM 199.7 MB iOS App
SoundTouch 2.52.ipa 25/10/2012 9:44 PM 198.7 MB iOS App
Design 2.0.ipa 20/02/2013 2:20 PM 175 MB iOS App
Comic Life 2.1.1.ipa 13/02/2013 2:12 PM 167.1 MB iOS App
Angela 1.0.ipa 20/02/2013 2:15 PM 154.8 MB iOS App
Home 3D 2.1.ipa 14/12/2012 3:09 PM 152.5 MB iOS App
StarmapPro 3.8.ipa 04/03/2013 1:18 AM 152.2 MB iOS App
IntroToLetters 1.4.ipa 14/12/2012 3:10 PM 150.7 MB iOS App
UNO 1.3.1.ipa 14/12/2012 2:55 PM 144.5 MB iOS App
Bubble Mania 1.1.2.ipa 20/02/2013 2:17 PM 139.3 MB iOS App
Cut the Rope 2.0.1.ipa 04/12/2012 4:42 PM 109.7 MB iOS App

If you look in your Trash, you may be amazed to see how many IPA files are in there. Those are old versions of iOS apps that iTunes has helpfully removed for you.

Your startup disk is almost full.
You need to make more space available on your startup disk by deleting files.
Do not warn me about this disk again
OK

Uh-oh. This message always seems to show up right when you're working on a massive project that you haven't saved yet, doesn't it?

Through the looking lens

Want to take photos with an iPhone without the inevitable shake that comes from tapping the screen? Matthew J.C. Powell shows you how to use your iPad to trigger the shutter.

YOU'LL NEED THIS

CAMERA FOR IPAD

Download the app from **tinyurl.com/az6tsjh**. Note that despite, the name,it also works on the iPhone and iPod Touch.

Smartphones have revolutionised photography even more dramatically than they've revolutionised communication. We're all carrying cameras with us wherever we go nowadays, and pretty good cameras at that. We're taking more photos of more things than ever before, but are we taking *better* photos? We don't think so.

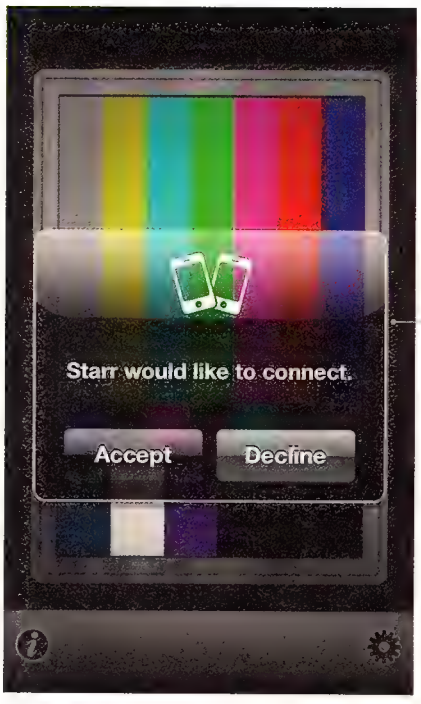
A big part of the problem is that most phone cameras require you to tap an icon on the screen to take the shot. Almost inevitably, unless you're a master of muscular control, this causes the lens to shake a little bit at the precise moment the shutter opens, leaving you with dramatic motion blur where none was required or desired.

With the latest models and the latest software, you can press one of the volume buttons on the side instead of tapping the screen, although even then you can still get some shudder. Owners of 'real' cameras have known this for decades and many cameras can be operated by remote control, so you don't need to touch the camera at all to take a shot, ensuring a shake-free picture every time. The good news is you can do that with an iPhone, too, provided you have another iOS device (a second iPhone, an iPod Touch or an iPad) and a couple of apps.

There are a few different apps in the App Store that will allow you to accomplish what we're trying to do here. For this tutorial, we're focusing on the 99c inaccurately named Camera for iPad (available from **tinyurl.com/az6tsjh**) – it's inaccurate because it runs on iPhones and iPod Touches, too. We'll also cover another pair of apps with more features, and there are many in between on the functionality continuum.

CHOOSE YOUR CONNECTION

Camera for iPad, like most of the other apps that do this, works over either Wi-Fi or Bluetooth. If you opt for Bluetooth, it's not necessary to pair the two devices before starting the app. Just make sure that Bluetooth is turned on for both devices, start the app on both and follow the prompts to connect. If you opt for Wi-Fi, the process is the same, although it's important that both devices are using the same Wi-Fi network. This may not be a consideration for most circumstances, but if you're out in public somewhere and your iPhone grabs the Wi-Fi from the nearest McDonald's and the iPad gloms on to the App Store, you could have problems.



Care to dance? With Camera for iPad running on both devices, pairing is very straightforward.

If you're out somewhere where there isn't Wi-Fi, but you don't want to use Bluetooth, don't panic – just use the 'Personal Hotspot' feature on the iPhone and connect the iPad to that Wi-Fi network. We've tested this and it works fine. If you don't know how to use this, see the box below.

Why would you bother with that, if Bluetooth is available? Well, for one thing Bluetooth is quite a bit slower than Wi-Fi, so if you opt to have the photos saved to the iPad they'll take longer to transfer over. Bluetooth has lower power consumption than Wi-Fi in general, but the longer time spent transferring photos might tip the balance in favour of Wi-Fi if battery life is a consideration (and it should be – you're using two devices at once here).

Camera for iPad gives you the option to save photos to the iPhone's camera roll rather than transferring them, which is great for extra battery life. However, it means you can't do any on-the-spot editing until later. You can also elect to take lower-resolution photos.

Once you're connected, whatever your iPhone's camera is pointed at will appear on your iPad's screen in more or less real time. You can set the quality of the preview to be lower, which speeds up refresh time and saves bandwidth – it doesn't affect the picture quality. Set up the iPhone on a shelf or somewhere it will be steady and secure, then go and lie in wait for the perfect photos. Unfortunately, Camera for iPad doesn't let you tap on part of the image to choose a focus or exposure point, so you have to hope the iPhone gets it right (it's usually pretty good).

SET UP A PERSONAL HOTSPOT

Recent-model iPads and iPhones have a feature called 'Personal Hotspot', which allows them to act as Wi-Fi base stations, sharing their internet connections with other devices. It's very handy if you have a laptop with no mobile internet and there's no Wi-Fi network available, for example.

To start up a personal hotspot on your iPhone, open the Settings app and tap on 'Personal Hotspot'. Then simply tap the slider to turn it on (and make a note of the password). Then, on your iPad, open 'Settings', tap on 'Wi-Fi' and then tap on the name of your phone. Enter the password and you're done.

You'll notice that on the 'Personal Hotspot' screen in the Settings app, there are instructions for using this function to share your iOS device's internet connection over USB or Bluetooth, not just Wi-Fi – a very handy function in the above laptop example, as you can switch off the iPhone's Wi-Fi and Bluetooth functions, and share its connection over USB to maximise battery life.

BLUX: THE DELUXE METHOD

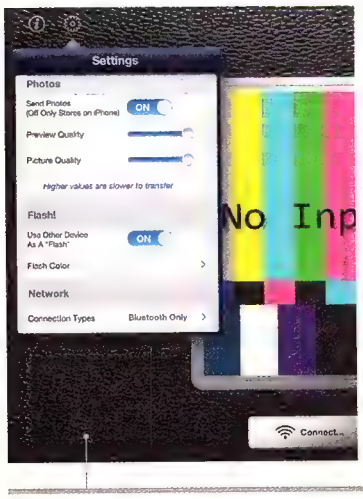
We're big fans of Blux Camera (**tinyurl.com/arcoctd**), a nifty app for iPhone or iPad (two separate $2.99 apps unfortunately, and not universal), which features an 'intelligent assistant' that offers advice on what settings you should use to take the best shots. It even downloads weather information for your location. One of Blux Camera's extra powers is the ability to use an iPhone as a remote lens. Sadly, for that you require another app, Blux Lens (**tinyurl.com/a27g2rv**), on the iPhone. It costs another 99c.

Blux also only works over Wi-Fi, not Bluetooth, although if a Wi-Fi network isn't available you can use the 'Personal Hotspot' method to connect. Once you have Blux Camera open on the iPad and Blux Lens open on the phone, you'll see a QR code on the screen of the iPhone. Tap the triangle in the upper-right corner of the iPad's screen, tap the camera icon and then the pairing icon. The iPad will scan the iPhone and the connection is made. When you want to disconnect, either tap 'Disconnect' on the iPhone or tap the 'X' next to the iPhone's name on the iPad screen. Unfortunately, the intelligent assistant function doesn't work in remote mode, but Blux's other cool features such as zooming and selecting various shooting modes do. So does tapping on the screen to select focus and exposure points. You do get something for your money.

Blux Camera's innovative method of pairing is so clever, it just might catch on.

Compared to Camera for iPad's minimal feature set, Blux Camera gives you a pretty sophisticated photographic interface. Use it wisely.

I've found remote photography very useful for getting more natural photos of my kids, who tend to 'mug' for the camera if they see me standing there. It's also useful for taking photos of animals, which are naturally skittish around humans. Of course, you'll need to choose your camera position well at the start, because there's no changing angles. And remember, you should always make sure your use of remote photography is both legal and ethical, and don't take pictures of people without their consent.



Above left: If you want to use the low-power Bluetooth connection, we recommend setting the 'Preview Quality' to 'Low' and saving pictures on the iPhone, rather than transferring them to the iPad. **Above right:** Camera for iPad works over Wi-Fi or Bluetooth and you should choose the connection that best suits your needs. Be wary of draining the battery in two devices at once.

Integrate your contacts with your social networks

Simon Chester shows you how to integrate info, profile pics and updates from your contacts into your address book.

YOU'LL NEED THIS

CONTACTS+

You can download this free app from Google Play at **tinyurl.com/c6ofk6c**.

I remember – back in those lazy, hazy days of Android 1.x – that Facebook used to sync all the profile pictures of my contacts, prettying up that otherwise bland part of my phone. Something changed along the way, however, and that functionality disappeared. So, now your phone book is populated with a host of blank faces, with smatterings of the occasional Google profile pic.

This functionality will likely come back when Facebook Home becomes a little more mature, but until then, there's another way to beautify (depending on your friends, that is) your contact list. While there are many different apps available on the Play Store that will allow you to do this, the replacement contact list app, Contacts+, not only makes the whole process very simple, it also brings with it a few other handy features worth pointing out.

As you'd hope, the app does more than just give you a replacement contact list. It also includes a replacement dialler, call log and messaging app, with an option for free messaging between other Contacts+ or WhatsApp users.

Perhaps best of all is that Contacts+ updates the contact images directly in your native contact list. That means if you don't like the way Contacts+ handles your contacts or phone calls, you can continue to use the standard People app and still see the contact's images. Note that if you uninstall Contacts+, the images will disappear after a reboot.

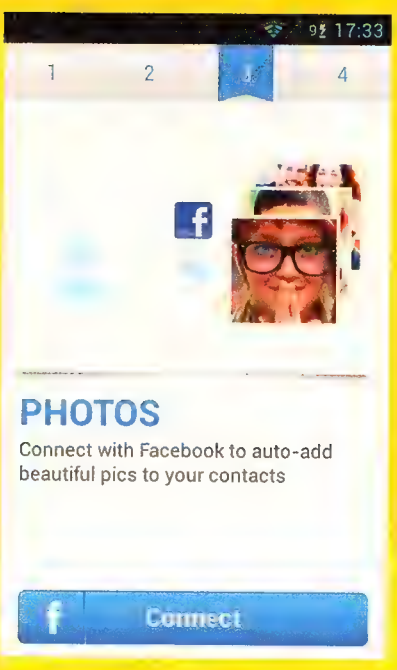
The Play Store contains links to all three apps – Contacts+, Messages+ and Call Log+ – although the last two are just shortcuts to the functionality built into Contacts+. These apps won't work by themselves and are really just there to provide you with links to the relevant section from other apps (in the Android 'Share' menu), or from your App Drawer or home screen.

To get Facebook profile pictures into your contact list, the first thing you need to do is install Contacts+ from the Play Store (**tinyurl.com/c6ofk6c**) – don't worry, it's free and the creators won't do anything funky with your contact list. All you then need to do is follow the onscreen prompts to download contact data (on the third screen, just connect with Facebook). Additionally, it will also download the Facebook cover image, visible when you open the contact.

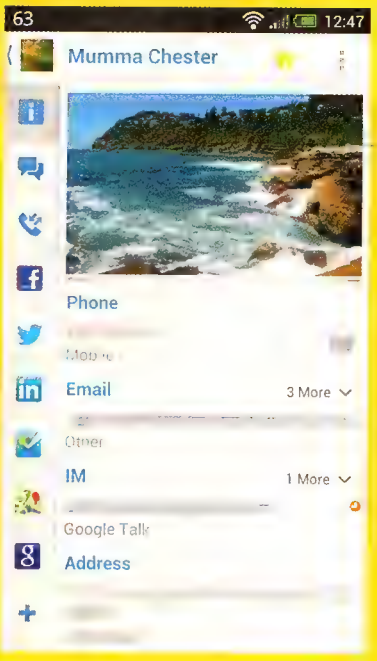
You'll also notice a whole heap of additional info available down the left-hand side of each contact's entry. Contacts+ also links your contacts to Twitter, LinkedIn, Foursquare and Google Maps for address information, or it can conduct a Google search. Don't use one of those networks? Just click on the little '+' symbol down the bottom and choose which services you want to show on the side.

We'd also recommend scooting over to the 'Settings' page, where you can select if you want the Facebook sync to run automatically, only on Wi-Fi and/or only when charging – of which we've selected 'Yes' to all.

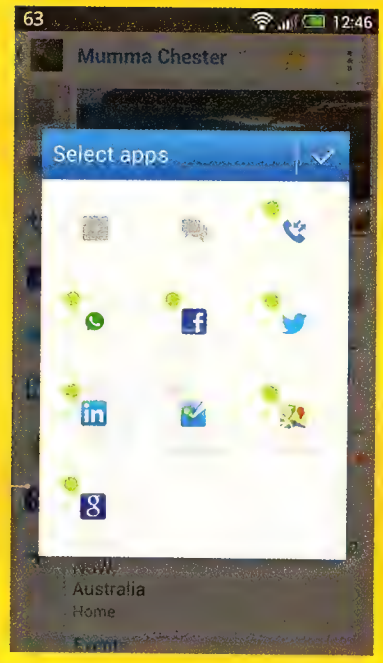
You'll probably also want to visit the 'General' section of the 'Settings' page and select the option to display only contacts with phone numbers and decide whether you want Contacts+ to push a little message to you whenever a contact has a birthday (it gathers this info from Facebook). apc



Contacts+ will ask you to connect to Facebook to add photos of your friends to contacts.



The app will download additional information for your contacts from Facebook automatically.



You can choose from a variety of social networks to integrate with your contacts.

Make & receive calls on your tablet

Simon Chester explains what you need to know to use VoIP on your data-only plan.

U'LL NEED THIS

A VOLP APP

Our choice of app is the free and open-source CSipSimple, available from **tinyurl.com/9zlpqzw.**

A DID NUMBER

We got ours from Whirlpool at **tinyurl.com/cuu6lhj.**

Tablets are so very close to being the do-it-all devices of a tech geek's dreams, so it's almost counter-intuitive that they can't natively make phone calls. Of course, the reason for this is it's more financially beneficial for telcos to sell you a plan per device than it is one plan for your one device.

We get great pleasure from sticking it to the man, although anti-corporate types aren't the only ones who may want to use their tablets as a phone. For instance, you may have accidentally dropped your handset down a porcelain hole and need something for making phone calls while you save up for a replacement.

While the lack of an earpiece is simple enough to circumvent with a hands-free kit, most tablets unfortunately don't actually include the digital guts required to make phone calls. That means even if you put a SIM card with a voice plan in your tablet and then install a 'dialler' app, you still can't initiate or receive phone calls. So, what can you do?

You can tap into the power of VoIP. VoIP can offer really cheap calls as a perfect addition to the data-only plan in use on your tablet (there are some telcos that block VoIP on these plans, though, so ping your VoIP server from your tablet to check if it responds before signing up to anything). Additionally, you can use VoIP when your tablet is connected to Wi-Fi and not have to worry about eating into your precious mobile data allowance.

There are many different VoIP providers available in Australia, including many ISPs. Almost every provider will offer free calls to other users of the service and some even have no monthly fees – just don't expect to be able to call a 'real' number without paying for it. Try to find one without contracts and decide if it's worth paying a monthly fee for cheaper calls, or the ability to receive calls.

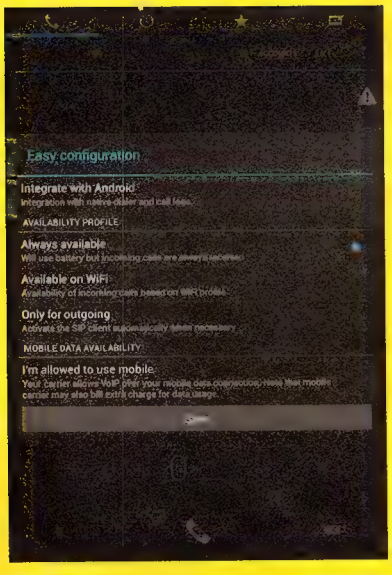
That's right, if you wish to receive calls from users outside the VoIP network, you'll also need an inbound number. Getting an Australian Direct Inward Dialling (DID) number also costs money, although there are many free providers of US/overseas numbers, if you're looking for a foreign one. The cheapest we could find was $5 per year plus a once-off $20 purchase price, available as a Whirlpool special at **tinyurl.com/cuu6lhj**. If you prefer another company's outbound rates, but they charge more than $5 per year for a DID, you can always configure your VoIP client to use a different provider for outbound calls, while still receiving calls on your DID.

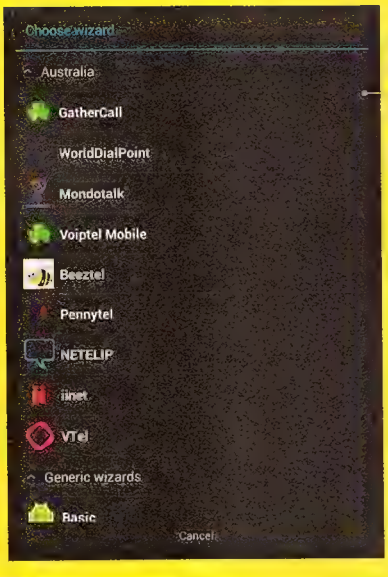
If you're using this as a temporary set up while you get a replacement handset, then you'll want to remain contactable on your old mobile number. You can either change your voicemail message to contain your DID number or set up call forwarding from your mobile number. Note that for each call you forward, you'll be charged as if you called your DID number from your mobile, so only set this up if you have a generous local call allowance on your mobile plan.

There are heaps of free VoIP apps available on Android, but our recommendation is the free, open-source CSipSimple. Handily, it supports multiple accounts, offering you a choice of your accounts each time you make a call, so you can sign up to different providers with different strengths and then pick the best. Best of all, it comes with setup wizards for some of the most popular VoIP providers, as well as the ability to create new accounts for some.

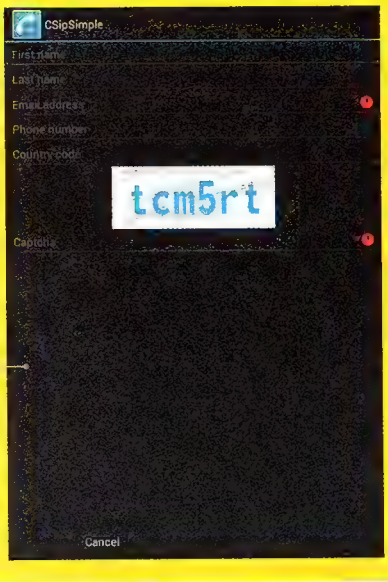
A detailed FAQ is available at **tinyurl.com/b84tra6** and information on writing filters to automatically assign certain numbers to use particular accounts is available at **tinyurl.com/amb6oou**.

You can opt to use VoIP only when your tablet is connected to Wi-Fi.





CSipSimple supports multiple accounts, so you can sign up to numerous providers.



Creating a Mondotalk account is as easy as filling in your details.

Connect to your PC

Neil Mohr shows how you can connect to your PC from anywhere using RDP.

YOU'LL NEED THIS

WINDOWS

The computer you wish to connect to will need to be running Windows Pro, Business or Ultimate. The connecting computer can be running any version of Windows.

A STATIC IP

If you don't have one, you can get the next best thing at **www.no-ip.com**.

What is Windows RDP (Remote Desktop Protocol)? It's the service that enables you to log into a networked Windows PC remotely as if you were sitting right in front of it. It's a great tool for accessing headless servers, or just for the lazier folk among us who can't be bothered to get up to sort out a PC issue in another room. RDP is great because it's a standard part of Windows and it's super-fast – rather than streaming the entire desktop image (as services like LogMeIn do), it can get away with capturing just the underlying data structure to recreate the Windows desktop locally. More importantly, Windows RDP ties into the existing Windows Groups and User system. This means it can be made pretty secure. There are some restrictions on the versions of Windows that can instigate an RDP server, but any version can access a running server, so that's where we'll get started.

You can use any version of Windows to connect to a PC running Windows RDP service. The issue is that generally only the Pro, Business and Ultimate versions offer the Windows RDP host service, which is the bit that sends the desktop. If you're running Windows Server – yes, it's unlikely – you're also good to go, but be aware that only one user at a time can see the screen.

SET UP USER ACCOUNTS

01 Before starting anything, we need to set Windows so it'll accept Windows RDP connections. Right-click 'Computer' in the 'Start' menu and choose 'Properties > Remote settings'. In the 'Remote Desktop' section, select the middle 'Allow...' option (see image **A**). The last option will enhance security, but you need the latest Windows updates.

02 To add existing users for remote access, click 'Select Users...' and then the 'Add' button. For extra security you should consider creating a new user account with restricted permissions. To do this, right-click 'Computer', select 'Manage > Local Users' and then 'Groups > Users'. Finally, select 'Action > New User'.

03 Anyone can potentially access this over the internet, so choose a complex username and a strong password. A long, memorable password is better than a short random one, or even a short word with a number and capitalisation. Deselect the 'Change' option and tick 'Cannot Change'.

04 Create the new user, double-click the entry and click 'Member of > Add > Advanced > Find Now > Remote Desktop Users' to add RDP privileges (see image **B**). You may want to remove this from any other user accounts. You can also move them from the 'Users' group to the 'Guest' group for restricted access.

PREPARE YOUR NETWORK

05 Before continuing, you should check that RDP and the new user account are working. Jump on another PC or RDP client and try to log in over your home network. Click 'Start', type Remote Desktop Connection and run it, or find it in the 'Programs > Accessories' folder. Enter the remote PC's name or IP address to get going.

06 Windows RDP server works over TCP port 3389. For additional security, we'll connect to the router over the internet to a randomly selected port. The available range of general ports is from 1024 to 65536. Depending on your router, configure it to forward that port to the IP of your PC and to port 3389 (see image **C**). Try **www.portforward.com** if you don't know how to do this.

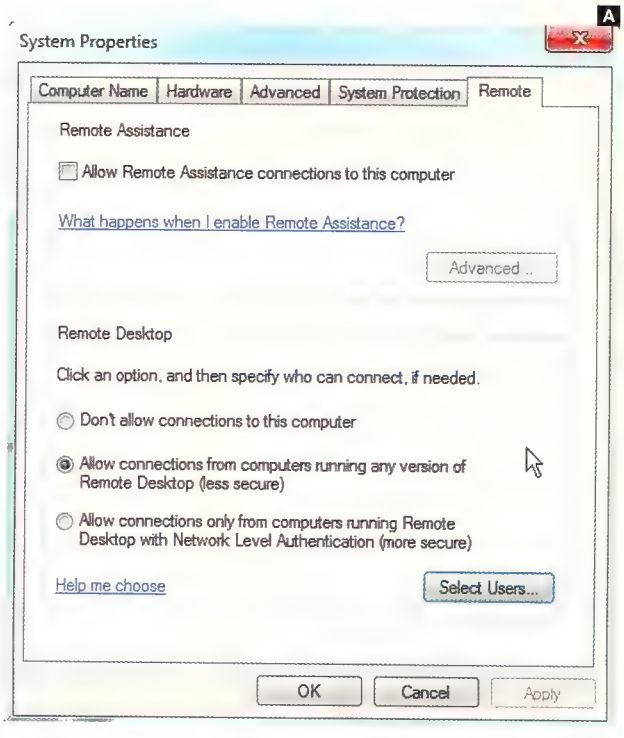
07 Again, this depends on your broadband router, but somewhere in its interface you'll find the external IP address your ISP has assigned to your router. Try looking in the 'Logging' or 'Internet' section. You can Google What's my IP? and the search engine will tell you. If you don't have a static IP then you'll need a DDNS service like those offered by **www.no-ip.com**.

CONNECT REMOTELY

08 So how do you connect to a remote desktop that's using its own port with the RDC program? Under the 'Computer' section you need to enter the external IP of your router, then a colon and then the port number – all with no spaces. Click the down arrow and you can also add the username, which will be used to log in (see image **D**).

09 Click the 'Experience' tab to see how you can speed up your remote desktop experience. You can leave all the options off, but 'Visual Styles' and 'Desktop Composition' don't slow things down too much. Under 'Display' you can select a lower resolution and reduce the colour depth, although this might rearrange your desktop.

10 To really test this out, you'll need access to a connection outside your own home network. For many, the easiest option is to fire up your smartphone and use it to create a wireless



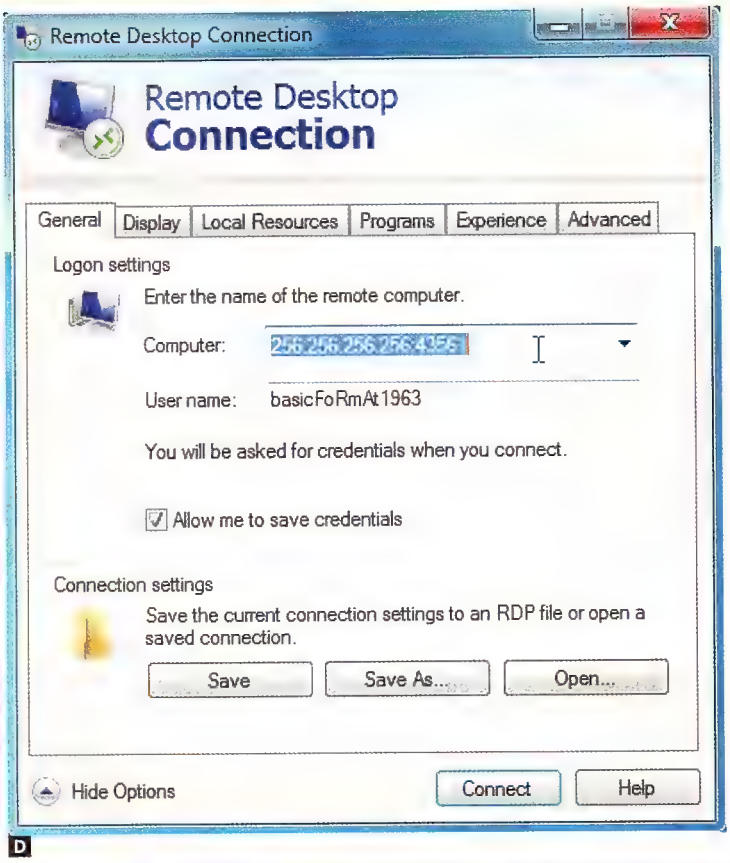
hotspot or access the remote system from it directly. Bear in mind that this will connect via the mobile network, so data charges may apply.

11 So far we've only talked in terms of access from other Windows systems, but Windows RDP clients exist for all systems including Android and Apple iOS. 2X Client offers free apps (**www.2x.com/rdp-client**) for a wide variety of platforms (see image **E**). Download the one that suits your needs and configure it the same way as the Windows one we've covered.

TWEAK RDP SECURITY

12 Windows Firewall is pretty comprehensive and you can restrict RDP access to systems from specific IP addresses. If you know these details, it can be a very secure option. Click 'Start', type **Firewall** and select 'Windows Firewall with Advanced Security'. Select 'Inbound rules > Remote desktop > Scope' and set the IP here.

13 If you no longer need external access, there's a level of tidying up that will secure your system again. First, remove the forward port from the router. Second, remove remote access privileges or remove the user from the system entirely (see image **F**). Finally, if you don't plan to use it, you can remove remote access, reversing step 2 entirely.



D

2X Client RDP/Remote Desktop
2X SOFTWARE LTD
5,010
Open
Uninstall
1.90MB
WHAT'S NEW
Added: Support RDP Connection with Windows 8 and Windows 2012
Added: New Keyboard layouts US, UK, FR, IT, DE, SP, NL, RU ,PT

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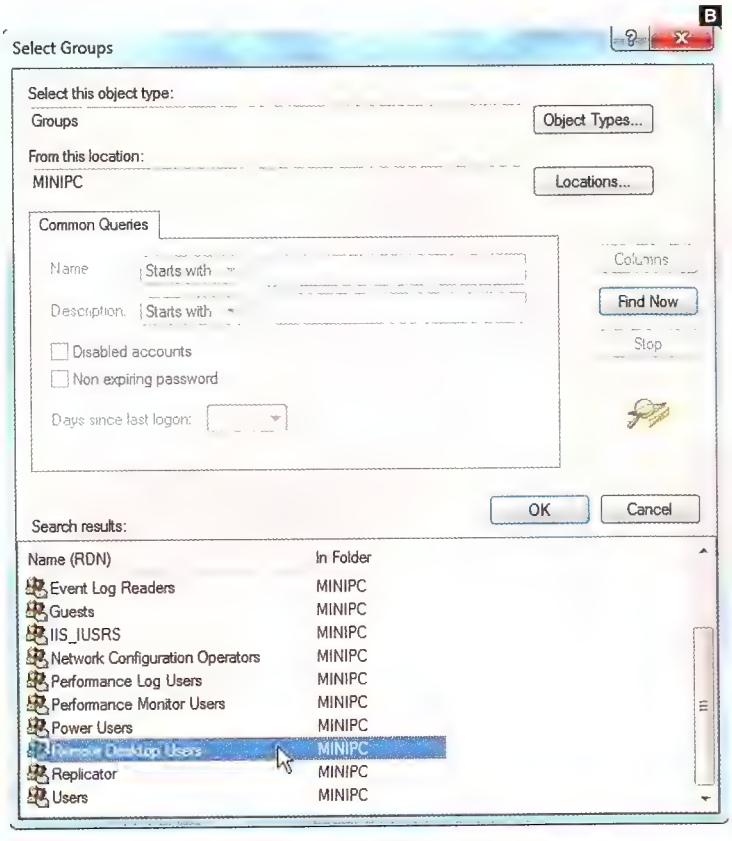
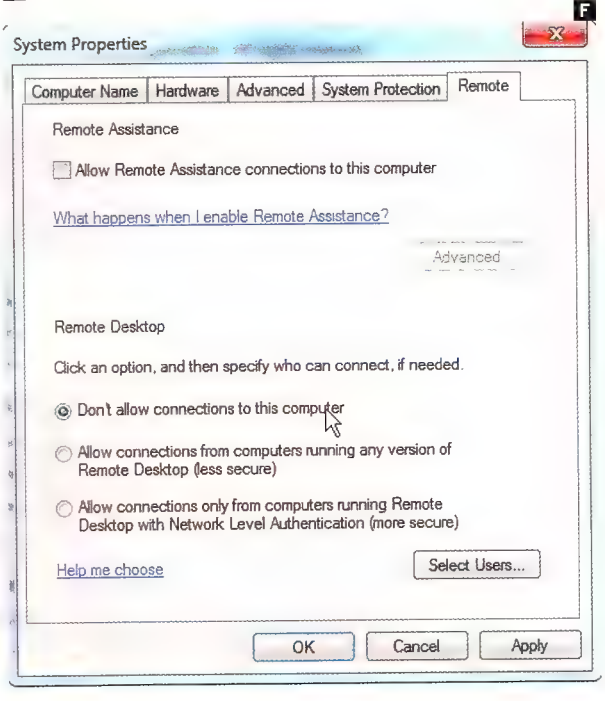
E



B


System Properties
Computer Name
Hardware
Advanced
System Protection
Remote
Remote Assistance
Allow Remote Assistance connections to this computer
What happens when I enable Remote Assistance?
Advanced
Remote Desktop
Click an option, and then specify who can connect, if needed.
Don't allow connections to this computer
Allow connections from computers running any version of Remote Desktop (less secure)
Allow connections only from computers running Remote Desktop with Network Level Authentication (more secure)
Help me choose
Select Users...
OK
Cancel
Apply

F

html5 masterclass

STEP-BY-STEP TRAINING

HTML

PART 11

Modern UI effects

In this month's HTML5 masterclass, John Allsopp explains how to create modern-looking effects on your web sites using 3D transforms.

APC EXPERT

JOHN ALLSOPP

With a background in computer science and mathematics – and a great deal of good fortune – John Allsopp's life collided with the web in the early '90s. For nearly 20 years he has developed software for web developers, built web sites and apps, and written books, countless articles and tutorials for print and online publications. In 2000, he wrote *A Dao of Web Design*, which over a decade later continues to be widely cited as the theoretical foundation for Responsive Web Design.

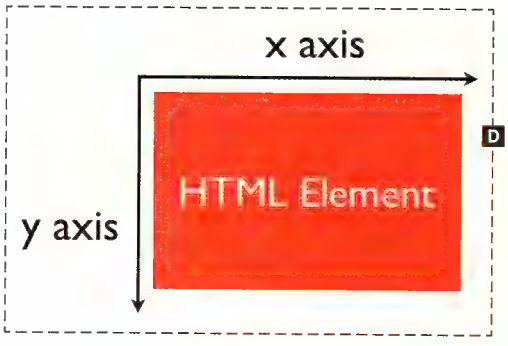
We've been on something of a journey these last few instalments, culminating last time by combining CSS3 animations and transitions with 2D transforms to create modern interactions as commonly seen on mobile platforms like iOS, Android, Windows Phone and BlackBerry. This month, we're going to take it a step further to create not just animations in two dimensions (like the sliding panels we saw last time), but 3D animations like card flips, carousel effects and even 'coverflow'-style effects.

But before we do, a quick word of warning. You might not be old enough to remember the `blink` tag, which exploded onto the web in the mid-1990s. Suddenly, it seemed like every page had multiple flashing elements. People quickly tired of this, but even coming up on two decades later, old web hands remember the eyesore that was `blink`. Let's use 3D animation with a bit more subtlety and discretion.

3D TRANSFORMS

The good news about 3D transforms is they're very similar to 2D transforms. However, instead of being able to move, rotate and otherwise transform elements horizontally and vertically on the page, we can now do so 'into' and 'out of' the page as well. Here are some simple 3D effects to give us a sense of what it's all about (see images A B C).

This last rotated element (C) might surprise you – it's the same as the 2D rotate function. So what's going on?



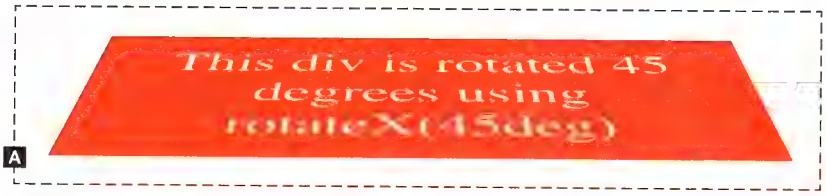
D The X and Y axes for 2D transforms.

First, it's important to remember that the axes for transformations are relative to the element itself, not the page it's in. So, with 2D transformations, the X axis is horizontal to the element and the Y axis is vertical (see image D).

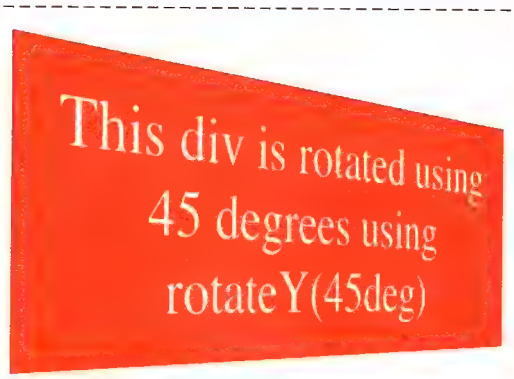
With 3D transforms, the X and Y axes stay the same, but a third axis, the Z axis, comes out of the plane of the element, perpendicular to both the X and Y axes (see image E).

With 2D transforms, there's only one way of rotating the object: around its transform origin. With 3D transforms, as we've seen, there are now three ways of rotating the element, around each axis.

We've taken a bit of time to focus on rotation, as it's one of

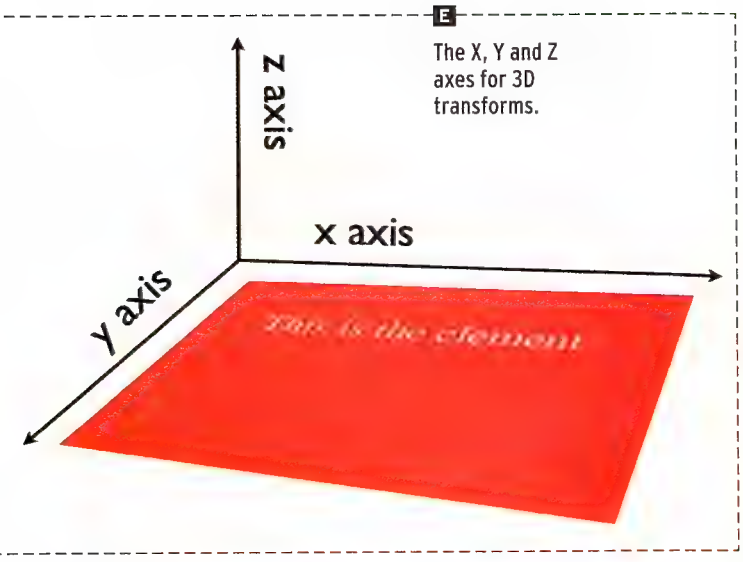


A An element rotated 45° using rotateX(45deg).



B An element rotated 45° using rotateY(45deg).

C An element rotated 45° using rotateZ(45deg).



E The X, Y and Z axes for 3D transforms.

the major transforms used in creating 3D user interface effects. Now let's get into the details of creating our 3D transformation.

GET SOME PERSPECTIVE

When we look at an object in the real world, its appearance changes depending on how far away we are from it. Not only does its size obviously change, but our perspective does as well. When we create 3D transformations using CSS, we can dictate the effect of perspective, in essence specifying how 'far away' the viewer is from the object.

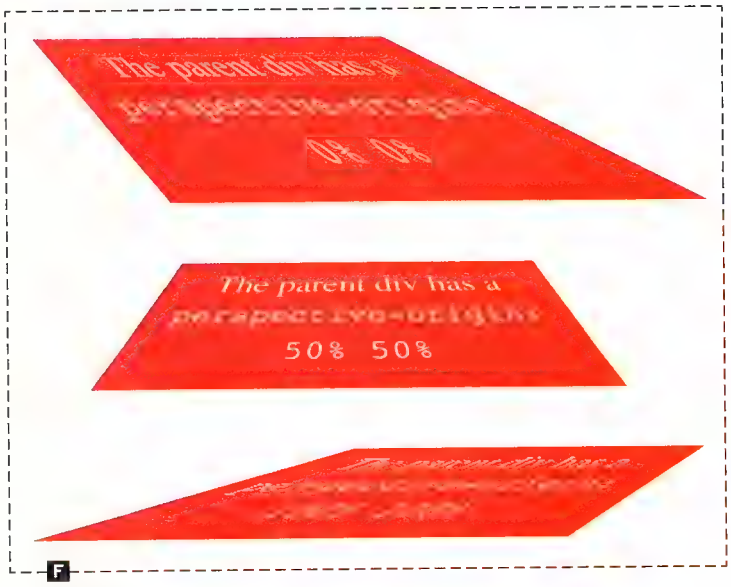
Here's our first gotcha for 3D transforms. We don't apply perspective directly to an element. Rather, we apply it to the parent (or other ancestor) of an element. This way, any elements that are descended from this element share the same perspective. To specify perspective, we use the `perspective` property. Here we'll take our element rotated in the X axis above and apply three different perspectives to see the effect. As we go along, you can view each example online at **tinyurl.com/ay48jf6**.

```
//this rule applies the rotation by 45 degrees about the X axis
.rotatex {
        transform: rotateX(45deg);
}

//these rules apply different perspectives to the parent of the rotated elements

        #perspective1 {
                perspective: 300;
}

        #perspective2 {
                perspective: 700;
}

        #perspective3 {
                perspective: 2500;
}
```

This is the result (see image F).

So, what's going on? The lower the value for perspective, the 'closer' the object appears to be. There's another important property associated with perspective, which again we apply to the parent of an element. Last time we saw how we can specify the origin for a transform; for example, rotating about the top-left corner of an element. Similarly, we can also specify an origin for perspective: are we looking directly at an object or from an angle? Not surprisingly, we use the `perpective-origin` property to specify this. We can use the keywords `left`, `center`, `right`, `top` and `bottom`, or percentage values, and even length values like pixels or ems as the value for `perspective-origin`. Let's see these in action.

```
#perspective4 {
                perspective: 300;
                perspective-origin: 0% 0%;
}

        #perspective5 {
                perspective: 300;
```



F Changing perspective with the same transform changes the appearance of the transformed element.

```
                perspective-origin: 50% 50%;
}

        #perspective6 {
                perspective: 300;
                perspective-origin: 100% 100%;
}
```

The above code results in the following (see image G). In the first of these, we've set the perspective-origin to the top-left corner of the parent element. In the second, the origin is the middle of the parent element and in the third, it's the bottom-right. If you've opened the example page, try changing the width of the window. Because the perspective is a function of the containing element, and that element's width changes as you change the window width, the appearance of the element changes as well. To stop this effect, we need to set a fixed width (in ems or pixels, for example) for the containing element.

So now we have the key concepts of 3D transforms:

- Elements have three axes: X, Y and Z.
- To see the effect of a 3D transform, the parent of an element *must* have a perspective. The lower the value of this property, the more pronounced the 3D effect will be.
- We can change the point at which the viewer perceives the 3D transform by changing the perspective-origin of its containing element.

With these in mind, let's rotate an element when the user hovers over it.

```
.rotatedPanel {
                height: 15em;
                width: 6em;
                background-color: rgba(255, 0, 0, .2);
                margin-left: 4em;
                padding: .2em;

}

.rotatedPanel:hover {
                transform: rotateY(22deg);
                transform-origin: 50% 50%;
}
```

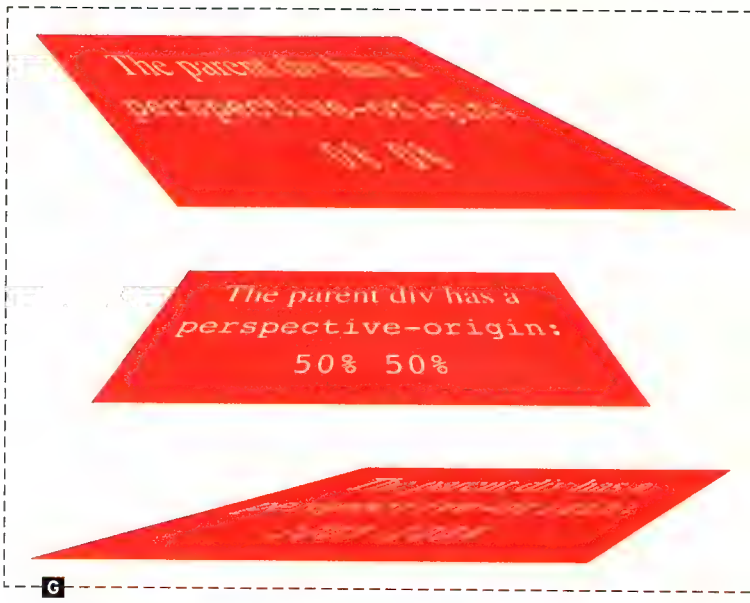
See image H.

There's just one drawback – if you try this out using the link to our demo page, you'll see the change is abrupt and jarring, not smoothly animated. However, we can use a really simple transition on the transform property. It's as simple as adding transition: transform 1s; to the .rotatedPanel statement. Now, when the user hovers over the element, it will rotate smoothly.

So far we haven't really done anything useful. Let's make something you might put to good use. In many mobile (and increasingly web) apps, we see a card metaphor. On the front of the card might be the main application functionality while on the back there might be additional information, lesser-used functionality or settings. Users can 'flip' from the front to the back card to bring up additional functionality.

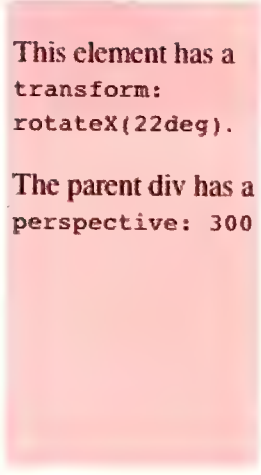
We'll use two div elements: one for the app functionality and one for the app info, and put both of these inside a container div. We'll then make the two contained cards fill the containing element and overlay one another, with just a little common CSS. Here's the HTML and CSS code for this first part if you'd like to follow along.

```
<div class="card-container">
        <div class="card">
                <div id="card-front" class="card-face">
                        <h1>This is the front card</h1>
                </div>

                <div id="card-back" class="card-face">
                        <h1>This is the back card</h1>
```

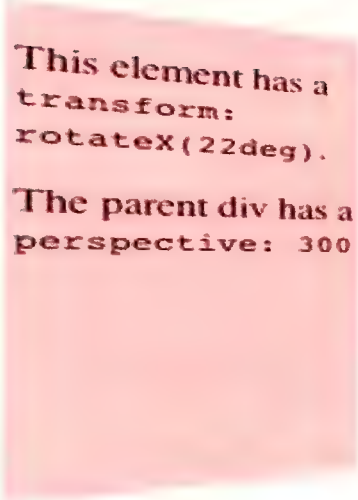


G Changing the perspective origin while keeping the same perspective and transform changes the apparent point from which we're viewing the transformed element.

At the top is the element before being transformed. When the user hovers on it, it's rotated and appears as below. H




```
                </div>
        </div>
</div>
.card-face {
        width: 100%;
        height: 100%;
        position: absolute;
        top: 0;
        left: 0;
        background: white
}

.card {
        position: absolute;
        height: 500px;
        width: 300px;
        border: solid thin grey;

}

.card-container {
        position: absolute
}
```



Next, let's rotate our containing element when the user hovers over it. It's more likely this would happen when the user clicks/taps a button, although this way we don't need JavaScript. For the container of our cards, we'll provide perspective so we actually get the 3D effect:

```
.card-container {
        perspective: 800;
        perspective-origin: 50% 50%;
}
```

Then on hover, we'll rotate the card element by 180° in the Y axis:

```
.card:hover {
        transform: rotateY(180deg);
}
```

While we're at it, let's animate this flip:

```
.card {
 transition: transform 1s;
}
```

Of course, we can't show you this here in print, but here's the result of the transition (see image I).

OK, so far so good, but how are we going to make the rear card face appear to be the right way round when its container is rotated by 180°? Why don't we just rotate the card face?

```
#card-back {
        transform: rotateY(180deg);
}
```

We're still not quite done, though. If we try this out, we'll still see the back of the front card reversed, not the back of the card rotated. We need to add two more properties. First, we need to hide the back face of our card elements so when they're flipped, we don't see them. We use the property `backface-visibility` with a value of `hidden` to do so.

```
.card-face {
        backface-visibility: hidden
}
```

Finally, we need to make sure that the descendent elements of our card container inherit the 3D perspective of their parent element, which we do by using the property `transform-style: preserve-3d` on the containing element; in this case, it's the element of `class = card`. Now if we hover over the element, we get what we expect (see image J). You can see this in all its animated glory online at **tinyurl.com/bakwkqz**.

BROWSER SUPPORT

3D transforms are wondrous features of modern web development you'll want to use with an eye to the reality that they aren't yet universally supported.

At present, support is good in Firefox, Chrome, Safari and Internet Explorer 10, and on Android 3+ and iOS devices. When using them, consider what happens where a browser doesn't support 3D transforms. In our card flip example, the reverse side of the card won't be visible, so we may need a different presentation for devices and browsers that don't support 3D transforms.

You'll also need to use the standard property names in conjunction with the `-webkit-` prefixed property names, as webkit-based browsers (Chrome, Safari, iOS and Android) all require prefixing. Pay particular attention when using transitions, which also require vendor prefixes. If we want to add a transition to our transforms as we've done in the card flip example, we'll want to ensure both the property (`-webkit-transform`) and the property we're animating (`-webkit-transform`) are prefixed, like so:

```
-webkit-transition: -webkit-transform 1s
```

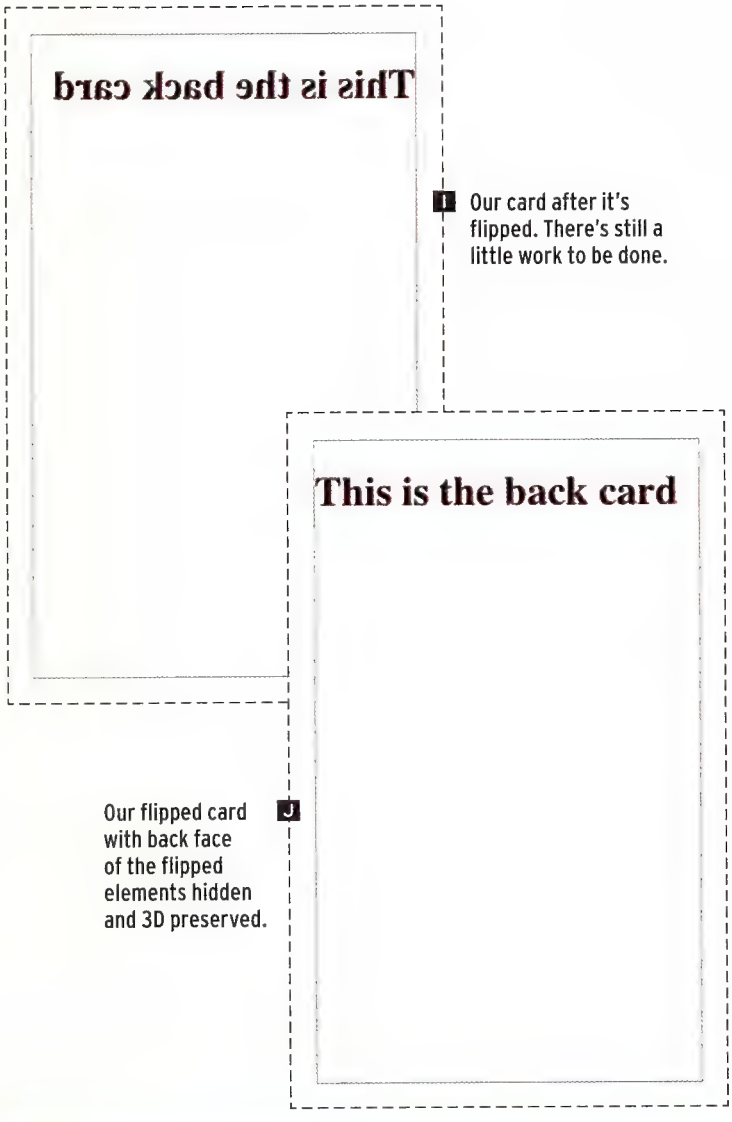
Of course, as is always required, also include the standard, non-prefixed property:

```
transition: transform 1s
```

WRAPPING UP

While it seems like there's quite a bit to these 3D transforms, once you've got the key ingredients of perspective, preserving 3D and back face visibility down, you're ready to start exploring what's possible. In the 'Examples & more reading' box below, you'll find some great examples of 3D transforms, as well as places where you can learn more and tools to explore transforms.

Next time we'll look at how we can speed up our web site load times and even make our sites work when the user is offline (provided they've visited our site at some point in the past) using the HTML5 Application Cache (AppCache for short). See you then.



I Our card after it's flipped. There's still a little work to be done.

J Our flipped card with back face of the flipped elements hidden and 3D preserved.

EXAMPLES & MORE READING

- Explore 3D transforms with my 3D transforms tool: **tinyurl.com/kccevgn**.
- An oldie, but still an excellent introduction to 3D transforms from 24 Ways: **tinyurl.com/lch6bn6**.
- Two visually stunning browser-based presentations systems (think PowerPoint in the browser) can be found at **tinyurl.com/cu9nx9k** and **tinyurl.com/kd2phf4**.
- One of the richest uses of CSS transforms, transitions and animations we've yet seen is Into the Artic. Visually delightful, interactive and highly animated, it demonstrates just how much can be achieved using these CSS features: **intothearctic.gp/#/map**.

PROJECT 8

Stompy the robot: Part 1

Darren Yates is back with his second robot build — a low-cost quadruped (that's a four-legged walker) called Stompy.

DARREN YATES

Darren is a multi-award-winning journalist who started building and testing computers in the early '90s. He's developed a range of PC software, including *PC User*'s UserBench benchmark series starting in 2005, its UserOS Linux distros in 2008 and is now working on new benchmarks for Android when he's not busy writing or torturing hardware with his soldering iron.

Our first Arduino robot called Rolly in our February issue proved to be a popular project. Powered by an Arduino Uno board, it was easy to put together and cost very little. This month, we upped the ante again with our first walking robot, appropriately called Stompy. He's a quadruped, a four-legged walker, and he's physically about as simple as you can make a walking robot.

If you look online, there are plenty of six- and even eight-legged robots, but the one thing they all have in common is that they usually cost a small fortune – upwards of $300 and typically closer to $500. We've found a much lower-cost alternative called the Dagu Quadbot, designed by Australian Russell Cameron, available from RobotGear (**www.robotgear.com.au**) for $55 including shipping. For that price, you get the main plastic chassis, the leg pieces and eight tiny plastic-gear servo motors; the rest, including the electronics that drive it, is up to you.

Plastic-gear motors mean you won't be tackling Mt. Everest with this little guy, although he should be enough to pique your interest and save you a fortune buying something else.

OUR DESIGN

Normally, servo motor-based robots require a specialised controller board designed for the purpose and there are a few around. You can also use a standard Arduino Uno board, although because Arduino and servo motors have different voltage requirements, you typically see Arduino-based bots with two batteries: the standard four AA cells for the servo motors and a 9V battery for the Arduino board itself.

PARTS LIST

Part	Cost	Source
Arduino Uno R3	$13.20	tinyurl.com/cojru78
Arduino Sensor Shield V5.0	$4.86	tinyurl.com/d6qkhev
Dagu Quadbot chassis kit	$55	tinyurl.com/dyx6ewt
DC-to-DC converter	$3.14	tinyurl.com/cxaez45
SPST toggle switch	$1.95	tinyurl.com/c86rh6j
HC-SR04 sensor	$1.88	tinyurl.com/bsewdxt
TowerPro SG90 servo motor	$2.37	tinyurl.com/bncsnp5
470uF/16VW electro capacitor	$0.75	tinyurl.com/c8e83rn
TOTAL COST	$83.15	

However, we've come up with a unique design that sticks with an ordinary Arduino Uno board and only needs the basic four AA-cell battery.

The basic problem we've overcome is that the Arduino's ATMEGA328P chip needs 5VDC power, but you need to feed it at least 7VDC to allow the onboard voltage regulator enough head room to generate the clean 5VDC needed. That's a problem because the lightweight servo motors in this kit will blow up if they're fed with 7VDC. What's more, the Arduino's regulator can't drive the servo motors directly.

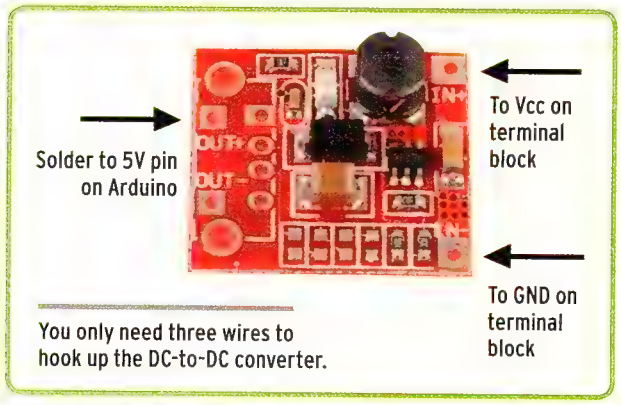
ARDUINO SENSOR SHIELD V5.0

We're introducing another Arduino expansion board this month called the Arduino Sensor Shield. It's a low-cost (under $8 shipped) board that allows you to connect a range of sensors to your Arduino using easy-to-attach jumper cables. It's a simple board with no electronics on it, other than a couple of resistors and an LED. Its main role is to supply those header pins to make it easier to attach external devices, like our servo motors.

HEAVY LOAD

Stompy requires nine servo motors all up: two for each leg and one for the neck; however, the electrical demands of powering those motors puts a heavy load on the power supply. Given we're using four AA Nickel Metal Hydride (NiMH) rechargeable cells, we have plenty of power yet not much voltage – around 5.5VDC at best under no load. As soon as we ask the battery to handle those motors, its voltage begins to sag to below 4.5V. As soon as that happens, the Arduino Uno drops below its operating voltage and resets itself. This results in Stompy starting and stopping, starting and stopping as the battery voltage yo-yos up and down.

The quick and dirty solution is to use two batteries: four NiMH cells to deliver 4.8-5.2VDC for the motors and a small



You only need three wires to hook up the DC-to-DC converter.

Stompy, the walking robot. Isn't he cute?

USE NIMH RECHARGEABLES

Single-use AA batteries are convenient, but a waste. They're also Stompy's Kryptonite. Standard AA batteries deliver around 1.6VDC voltage with no load. Add four together and you're looking at 6.4VDC, which is too much for our DC-to-DC converter. With an input voltage that high, the output becomes the input minus the blocking diode voltage drop (0.6V), which can be as much as 5.8VDC. Connect that directly to the Arduino and it'll blow up. At best, NiMH cells deliver 1.4VDC or 5.6VDC in a four-cell block. Take away that 0.6V diode drop in the DC converter and the highest voltage output you'll get is 5V flat. As the voltage drops, the DC converter kicks in and ensures the output stays at 5VDC and the whole thing runs happily. So just remember, NiMH cells only.

single-use PP3/9V battery to power the Arduino. Personally, we hate that solution – it's just dodgy. You've now got two power sources to check and you're using a battery that was designed for transistor radios in the 1950s, not driving microcontrollers. What we need is a solution that fixes the voltage reset issue without needing that PP3 battery.

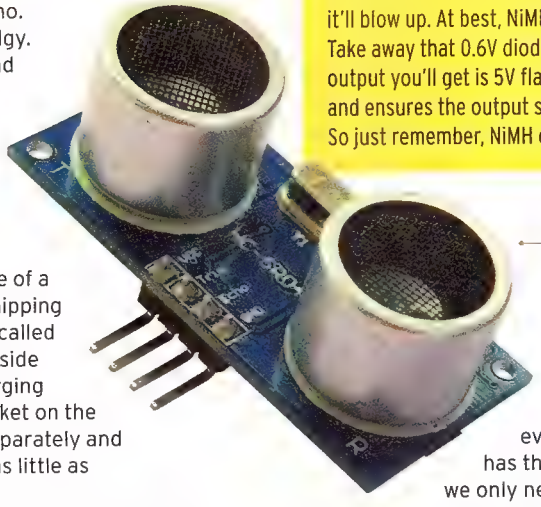
DC-TO-DC CONVERTER

The solution is a tiny little circuit board the size of a postage stamp. It costs around $3 including shipping on eBay and solves the problem perfectly. It's called a DC-to-DC converter. They're normally sold inside cases to act as emergency USB power for charging phones, or on their own with a USB Type A socket on the end, although you can buy the circuit board separately and use it to deliver 5VDC at up to 1,000mA from as little as 2.5VDC input.

How it works will take more space than we've got, but here's the abridged version. It uses a charge pump that switches a small inductor on and off at a high 1MHz frequency. Inductors are weird components that try to maintain their electrical field when the current is switched off by raising their voltage. The voltage is dumped into a capacitor through a fast-recovery blocking diode and regulated by the switching circuitry to a very steady 5VDC.

So instead of powering the Arduino Uno directly from the battery, we solder a connecting wire from the DC-to-DC converter's output directly to the 5VDC pin of the Arduino and bypass the onboard regulator. While the battery voltage varies significantly under the load of the motors, the converter provides a regulated 5VDC output that keeps the Arduino happy. Most importantly, the whole thing is powered by just one battery.

However, there's one other issue: the servo motors are driven by the sensor shield and the shield is connected directly to the battery. The shield is also connected to the Arduino with our DC converter voltage. In order for all of this to work, we need to separate the voltage rail of the shield from the Arduino, as the DC converter creates a new 5VDC voltage rail we have to respect.



The HC-SR04 ultrasonic sensor is just $2 on eBay, including shipping.

The solution is supplied by the sensor shield. Right near the battery input terminal block there's a PC board jumper. Remove it and the 5V supply rails are now separated and everything works. Make sure your sensor shield has this jumper, otherwise the robot won't run. Finally, we only need three wires to the converter: DC voltage in, the 5VDC output and the common ground (0V) line that goes to the battery ground and the Arduino's ground plane. The fact that it's a common ground means we only need one ground connection to the DC converter. Apart from wiring up the power switch connected to the battery, the only soldering you need is the three wires to the converter.

TURNING HEADS

We've borrowed the same basic eyes and neck from our first robot, Rolly, and used them here to give Stompy some corrective feedback. The HC-SR04 ultrasonic sensor sends out 40kHz bursts and measures the time for the echo to return to give us an accurate distance in front. By putting the sensor on top of another servo motor, we can rotate the sensor and scan the surroundings without having to move the whole robot in that direction.

POWER

Finally, to keep things compact, we've used a basic four-cell battery holder stuck to the underside of the Perspex base and included a single-pole single-throw (SPST) switch to quickly control power.

How to build Stompy

The first step to putting Stompy together is obviously gathering the parts. All up, without batteries, it shouldn't cost more than around $80, which is as cheap as you'll find for a quadruped.

The Quadbot kit comes with a basic yet functional manual showing how to mount the servo motors onto the leg mounts and the legs onto the chassis. You'll need a small 3mm Phillips-head screwdriver and to keep track of the screws – they're quite small.

The toughest part is ensuring that you install the servo motor attachments with the motor in the middle of its travel. Servo motors like this have a 180° turn arc and to make Stompy work properly, each motor needs to be mounted so that it's sitting halfway through its spin arc. You don't need to be exact (we can fix this with software), but you need to be at least in the same postcode as the middle. Turn the motor with the attachment on, but don't force it – plastic gears are easy to strip.

The four-AA battery holder is attached to the bottom of the chassis with double-sided tape.

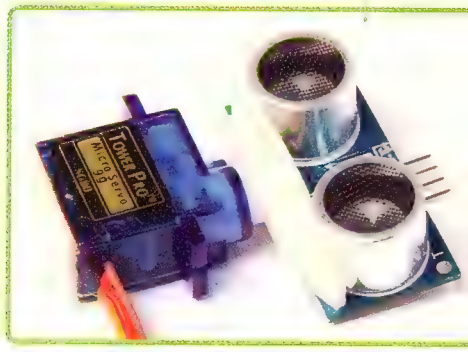
Stompy's ultrasonic sensor attaches to the servo motor arm with double-sided tape.

INSTALL THE SWITCH & BATTERY PACK

In our build, the curved end of the Perspex chassis is the rear and there's a neat 6mm hole in the centre, which is just perfect for a SPST toggle switch for the power. The four-AA cell battery holder is just a basic barebones type with two flying leads, which you can get from eBay (Jaycar doesn't stock this one), and we used 3M mounting tape to stick it to the bottom of the Perspex chassis, just north of the switch (remember to remove the protective plastic from the Perspex first). The red wire is positive volts, while the black is 0V. Solder the red wire to one side of the switch. Next, create a short lead using hookup wire, solder one end of that to the other side of the switch and connect the other end to the VCC terminal on the Sensor Shield's terminal block.

HC-SR04 WIRING TABLE

Sensor pin	Sensor Shield's URF01 port pin
Vcc	1 (+)
Trig	2
Echo	3
GND	4

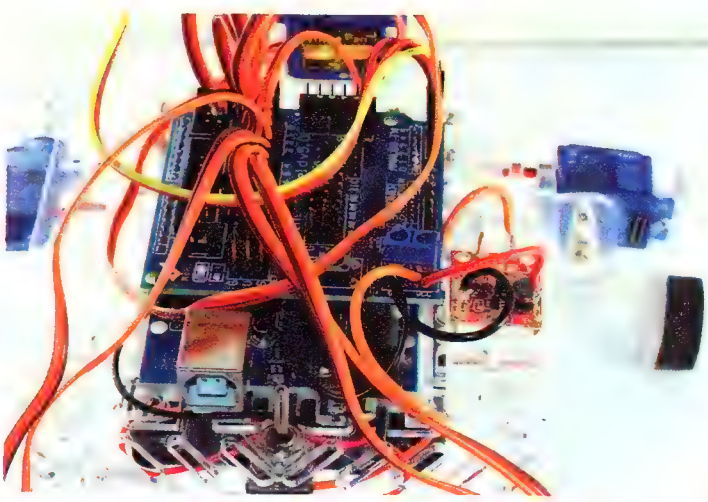


INSTALLING & WIRING THE DC CONVERTER

The most pressing thing you need to attend to is working out the location of the Arduino and DC converter boards. The Arduino should be in the centre, just north of the switch. Looking from the back, place the DC converter on the right-hand side as that's the side the Arduino's 5V pin is located. You need to solder three short hookup wires to the DC converter: one for the input voltage from the terminal block, one for the 0V plane and finally, the output voltage; the other end of this wire you carefully solder to the 5VDC pin on the Arduino. Use gold PCB pins on the DC converter to make it easier to solder and unsolder the wires (you can get these from Jaycar (**tinyurl.com/bmntnf4**).

Since most budget Arduino Uno boards use DIP (dual in-line package) ATMEGA328P chips, you're not soldering onto a surface mount point, so it shouldn't be too difficult to do. Just keep your soldering iron clean, pre-tin the wire you're soldering to that point and it should go like clockwork. If you're worried, you could use a pair of needle-nose pliers to lift the ATMEGA328P chip out of the socket first, solder the wire and put the chip back in, but that shouldn't be necessary.

Once you've got the wires soldered into place, it's time to mount the boards to the chassis. Again, double-sided 3M mounting tape FTW.



The DC converter sits on the right as you look from the rear, near the Arduino's 5V pin.

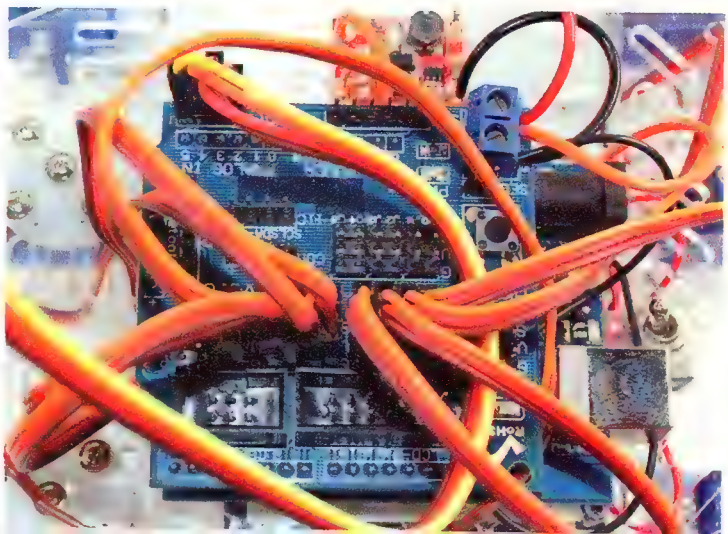
The servo motors plug into the sensor shield (use the table for numbering).

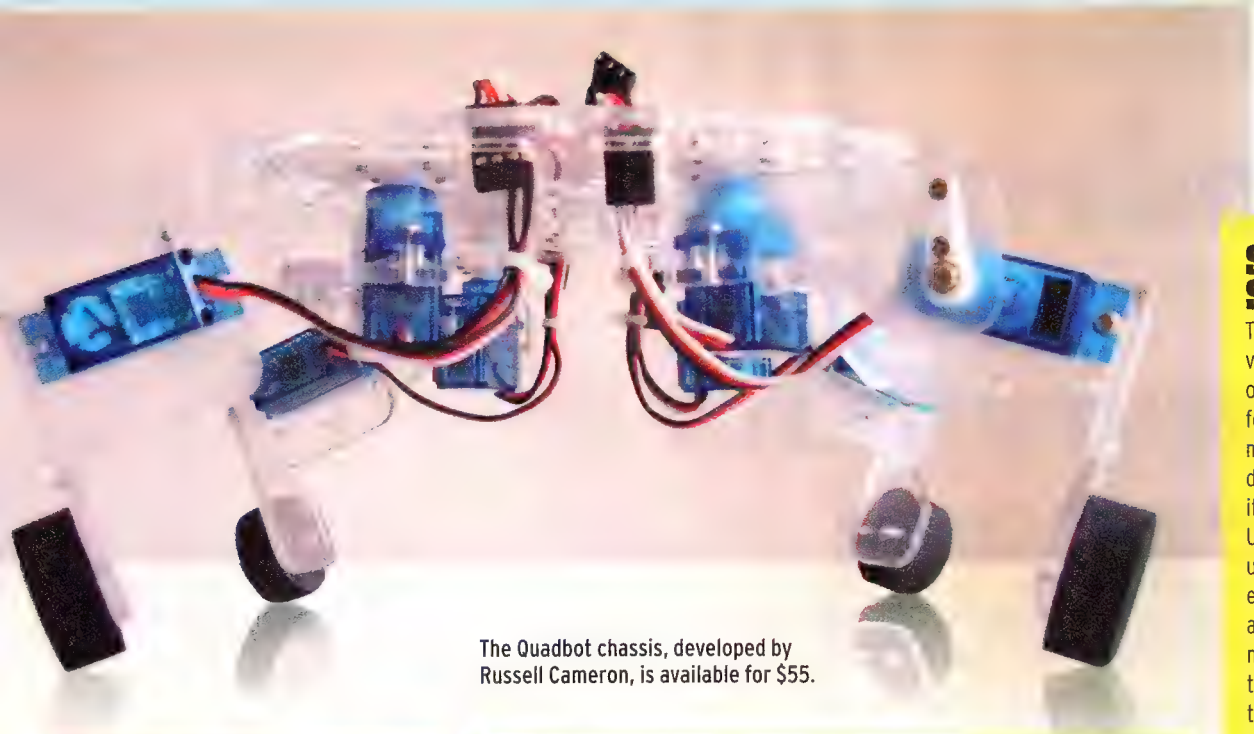
INSTALLING THE ULTRASONIC SENSOR

We use the same mechanism here that we used for our Rolly robot. Use double-sided tape on the bottom of the front servo motor, the long straight servo attachment and under the two ultrasonic sensors, and mount it onto the servo attachment. Four female-to-female Dupont wires are needed to connect the ultrasonic sensor to the UFR01 inputs on the sensor shield. Just follow the wiring table to ensure you get the connection right.

CONNECTING THE SERVO MOTORS

The most complicated task is connecting the servo motor header connectors to the sensor shield board – not because it's difficult, but simply because there are so many and they have to go in the right location, otherwise Stompy will look more like he's crawling out of a pub at 4am. We're using the main row of connectors on the sensor shield.



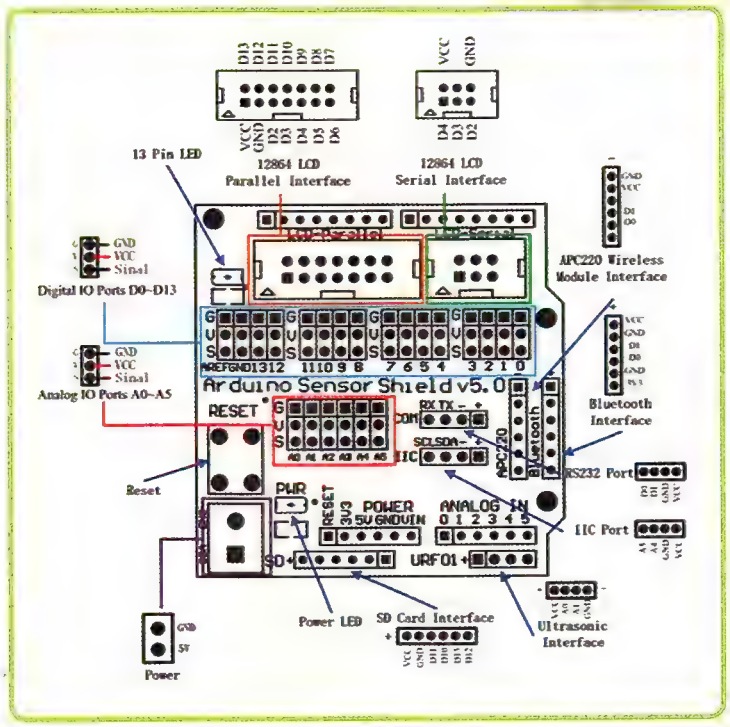


The Quadbot chassis, developed by Russell Cameron, is available for $55.

SERVO MOTOR TABLE

Servo motor	Short form	Shield jumper set
Front-left hip	FLH	5
Front-left foot	FLF	4
Front-right hip	FRH	6
Front-right foot	FRF	7
Rear-left hip	RLH	9
Rear-left foot	RLF	8
Rear-right hip	RRH	11
Rear-right foot	RRF	10
Neck	N	3

This overlay diagram lacks the voltage select jumper, but shows where everything else fits.



STOMPY SOURCE CODE

The source code is a modified version of Russell Cameron's original release. It was designed for the $40 Dagu Micro Magician microcontroller and an infra-red distance sensor. We've modified it to use the standard Arduino Uno board, an HC-SR04 ultrasonic sensor, added the extra servo motor for the neck and integrated the neck movement into the operation of the bot. We'll look at installing the code into the Arduino board next time (you can find the code at our Arduino web page at **apcmag.com/arduino.htm**).

Remove the jumper above the blue terminal block to get Stompy working.

This block diagram shows how Stompy works.

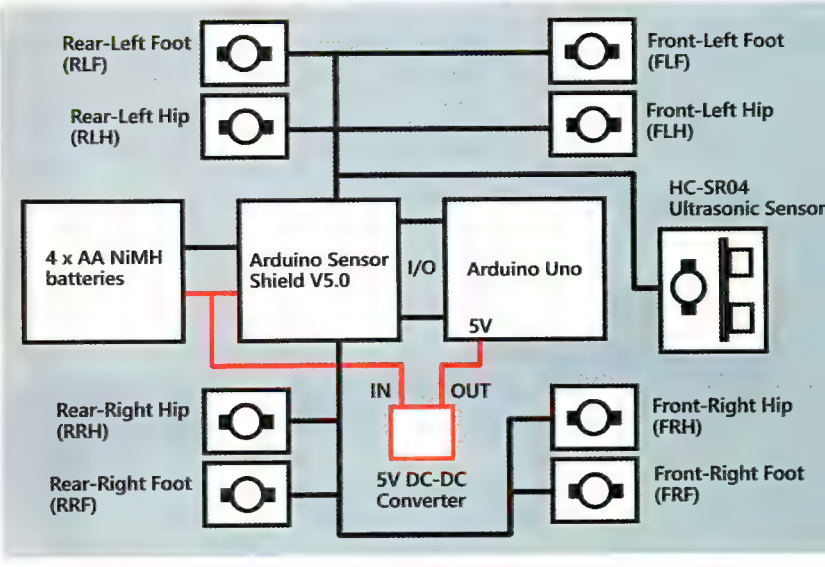
You'll notice at the end the letters G, V and S: G is ground/0V, V is Vcc or V+ and S is signal. Basically, each servo motor will have three wires: orange, red and brown. The brown wire end of the header should go into the ground G side of the header pins. Follow the wiring table to ensure you get the motor connectors into the right pin row.

CONNECT WIRES TO THE TERMINAL BLOCK

The big blue/green terminal block on the sensor shield is pretty simple: two screws mash down onto individual metal plates, jamming the wires pressed into the openings. Just make sure you tin the wires before inserting them into the block, otherwise the thin copper strands will fray and blow away in the wind. We're cheating a little because we're using the block to take the battery power as well as the wires feeding the DC converter. You only need to use basic hookup wire for this (check out Jaycar), as the DC converter only needs to supply around 50mA to the Arduino board so there's no need to make them thicker than that.

NEXT TIME

In the second part of this project, we'll look at more troubleshooting. We'll also show you how to get the code into the Arduino and how you can modify it, change the walk speed and give Stompy a personality.



Big storage for your phone

Need more storage than just a microSD card? Darren Yates shows you how to connect SDHC cards, USB flash drives, even SSDs and hard drives direct to your Android smartphone.

DARREN YATES

Darren is a multi-award-winning journalist who started building and testing computers in the early '90s. He's developed a range of PC software, including *PC User*'s UserBench benchmark series starting in 2005, its UserOS Linux distros in 2008 and is now working on new benchmarks for Android when he's not busy writing or torturing hardware with his soldering iron.

There are a number of ways you can get files onto your smartphone and you're probably familiar with most of them: syncing files via your PC or laptop, copying them over your Wi-Fi home network and even more complex options like using cloud services such as Dropbox. But there are times when it'd be really handy to be able to just plug your storage straight into your phone. There are occasional devices, such as Acer's Iconia Tab A200 tablet, which score a built-in Type-A USB port specifically for this purpose, although they're the rare exception to the rule.

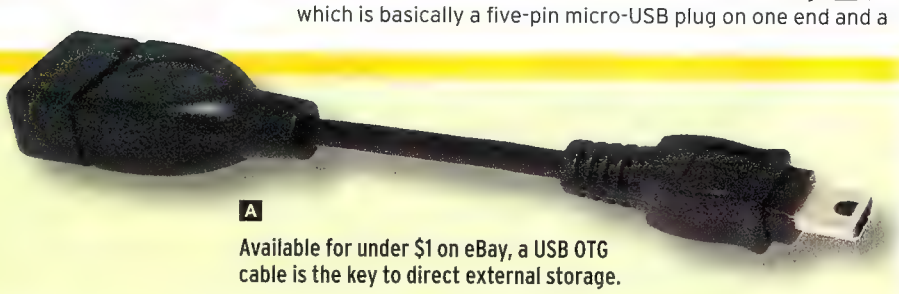
If there's a piece of smartphone hardware that really impresses, it's the modern incarnation of micro-USB. That might seem a spectacularly mundane choice, but if you're only using it to sync with your PC and charge the phone's battery, you're missing out. Not only do many new phones also use it to provide HDMI output to your big screen TV via baked-in MHL (Mobile High-definition Link) technology, many add a fourth string to the bow: USB OTG (On The Go).

When it comes to connecting traditional devices such as printers and keyboards on a single-port connection, USB is a top-down host-controlled system, where the host device sets the pace and the peripheral device does what it's told. A USB OTG port is a smarter USB standard that works both ways – it can act both as a host and a peripheral port, depending on the device and what it connects to.

Most late-model Android 4.0+ smartphones now support OTG as well as the generic USB mass storage device driver, making it possible to load in storage devices like USB flash drives straight into your phone via an OTG cable. That said, there are still some tricks involved. However, when you understand how OTG works, it's possible to connect USB flash drives as well as SDHC/SDXC flash cards, portable USB hard drives and even SSDs direct to your phone.

WHAT YOU NEED

The first thing you need is a USB OTG cable (see image A), which is basically a five-pin micro-USB plug on one end and a Type A USB port on the other. You can spend upwards of $10 if you buy one in Australia, but we managed to find ours on eBay for under $1 including shipping. It works perfectly on our smartphone collection and it'll work on any Android tablet with OTG support. If you have the choice, go for an OTG cable rather than a solid one-piece adapter. Adapters do place considerable weight strain on your phone's micro-USB port, whereas cables have natural 'give' that provides some helpful protection.



A

Available for under $1 on eBay, a USB OTG cable is the key to direct external storage.

B

A Galaxy S II phone can power SanDisk's super-quick ImageMate multiformat card reader.

Now we're ready to start hooking up different kinds of direct storage.

STORAGE #1: SDHC/SDXC CARDS

The vast majority of Android smartphones are designed to take a microSD card of up to 32GB, but an SDHC or SDXC media card? Forget it. Actually, don't forget it – plug a flash card reader into an OTG cable and your OTG-ready phone should recognise and mount the flash card onto the storage bus. If you shoot photos with a DSLR camera or capture video with a camcorder, your phone will also be able to display the images and handle most video formats (those it can't play can usually be handled with MX Player and its associated codec pack). You can then use the phone to transfer these files elsewhere.

We tested this using SanDisk's super-quick SDDR-289 ImageMate multiformat USB 3.0 card reader (see image B) connected directly to Galaxy S II and S III phones and it worked brilliantly.

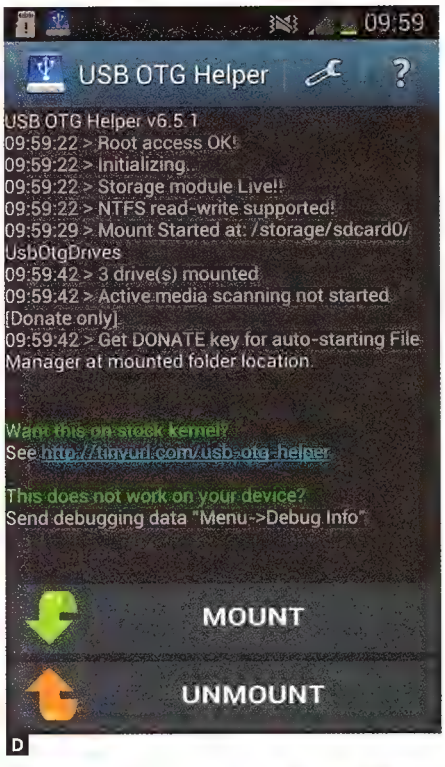
STORAGE #2: USB FLASH DRIVES

USB flash drives can be even easier to use (see image C), just

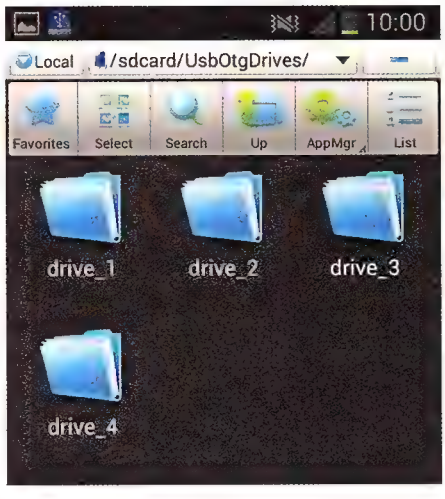
Samsung's Galaxy S II not only has MHL video output but USB OTG for big storage.

C

Corsair's USB 3.0 Flash Voyager drive happily plugs straight into a Galaxy S II via OTG.


09:59
USB OTG Helper
USB OTG Helper v6.5.1
09:59:22 > Root access OK!
09:59:22 > Initializing..
09:59:22 > Storage module Live!!
09:59:22 > NTFS read-write supported!
09:59:29 > Mount Started at: /storage/sdcard0/UsbOtgDrives
09:59:42 > 3 drive(s) mounted
09:59:42 > Active media scanning not started [Donate only]
09:59:42 > Get DONATE key for auto-starting File Manager at mounted folder location.
Want this on stock kernel?
See http://tinyurl.com/usb-otg-helper
This does not work on your device?
Send debugging data "Menu->Debug Info"
MOUNT
UNMOUNT

D



D USB OTG Helper mounts NTFS-formatted drives connected via OTG cable.

USB OTG Helper **E** mounts drives on \sdcard\UsbOtgDrives\.

plug them straight into the OTG cable and they should be detected by the phone. Remember, your phone has to support OTG for this to work. The good thing about flash cards and USB flash drives is that their power demands are quite low, so any device with OTG support should have no trouble powering them up. We tested this with a number of flash drives connected to a Galaxy S II phone, including 32GB USB 2.0 (Patriot Xporter XT) and USB 3.0 (Corsair Flash Voyager) models.

A quick note on transfer speeds. At this stage, all Android devices we've seen only conform to the USB 2.0 standard for OTG. That means theoretical transfer speeds top out at 480Mbps, until new SuperSpeed OTG-capable phones come on line.

ISSUE: FIXING NTFS SUPPORT

Both of the above storage formats should work perfectly in your OTG-ready Android smartphone without the need for third-party apps – unless they've been formatted with NTFS. Android natively supports FAT16/FAT32 and the popular Linux Ext2/3/4 file systems, although it doesn't know what to do with NTFS-formatted storage. Actually, that's not quite true – it will tell you you've mounted blank storage.

That's where the very helpful USB OTG Helper app comes in (see images **D** **E**). It not only mounts devices if Android itself fails to, but the latest version has NTFS support, so if you use this filesystem on your USB flash drives and cards, you'll still be able to access them with your phone's file manager. USB OTG Helper is free and available on Google Play (**tinyurl.com/lu29y4t**). The only drawback? It, like most similar apps, needs root access. If you use OTG Helper, you'll find your flash drives mounted under \sdcard\UsbOtgDrives\ using your favourite file manager.

STORAGE #3: USB PORTABLE HARD DRIVES

Flash cards and drives provide low-power storage and that's fine, but you're still reasonably limited in storage – flash cards and drives beyond 64GB are available yet not all that common. USB hard drives are still the most cost-effective portable storage option going around, but it's here that you'll run into a mix of problems to solve. While most drives are formatted with NTFS, this can be fixed on rooted phones by using USB OTG Helper, just as you would with NTFS-formatted flash drives and cards.

The main problem here is supplying bus-powered drives with sufficient power to start and run, as most phones simply can't do it. One phone that breaks the rule is Samsung's Galaxy S III (see image **F** on the next page). We got one to directly power a 500GB Seagate Expansion portable hard drive. However, while it worked, it's not something we'd do for long – the OTG port's power supply capabilities

would be severely stretched to handle a portable hard drive for any length of time.

We tried to get our Galaxy S II to have a go with the same drive and both devices got cranky straight away. Our recommendation is don't try this at home.

ISSUE: BUS-POWERED USB HARD DRIVES

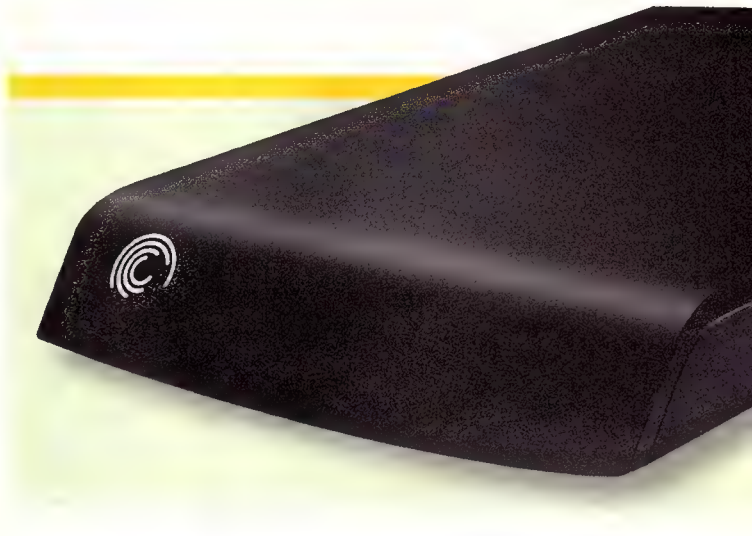
That doesn't mean it can't be done. The issue with bus-powered USB hard drives is pretty simple: how do you connect them to devices that don't have sufficient bus power to rev them up? Typical drives need 5VDC at upwards of 1A current in order to operate, which is way beyond the capacity of most phones. The simple solution is to use a powered hub and although there are few tricks to make this work reliably, it can be done.

The first problem is the hub having sufficient power in the first place. Too many powered USB hubs we've seen come with woefully underpowered AC power bricks. We recently purchased a seven-port USB 2.0 hub and found it only came with a 5VDC/900mA power brick. To have any hope of spinning up one (or more) bus-powered hard drives, you need at least a 5V/2A brick, preferably a 5V/3A brick, and power it with that. Try this one from Jaycar Electronics (**tinyurl.com/khxbouq**), although there are others (see images **G** **H**).

The other problem is the order in which you connect everything together matters. You should first power up the hub and then plug in your USB portable drive(s). After that, plug in the OTG cable into your smartphone and finally, plug the hub into the other end of the OTG cable.

There are a number of reasons why this seems to matter. First, your phone changes its USB mode based on detecting the OTG cable (the OTG port has a fifth ID pin that's grounded). Second, your phone expects drives connected to a hub to be powered up and live on the USB in order to detect them. We tried plugging in the hard drive after everything else was connected and no detection was made. It's possible the drive's initial startup current may have tripped something in the OTG port. We're not sure, but with a 5V/3A power brick, you have to get serious to find more power than that. It does work, though.

There is one annoying problem with this method, however, and that's the fact you can't use the powered hub to charge or power your phone via the OTG cable. The hub will power your portable drives just fine, but it won't provide power to your phone. The reason comes back to the OTG



cable and its ID pin. That pin trips your phone into host mode, meaning it's now set to supply (albeit limited) power to the peripheral device connected to it, not accept power from it (even though in this case, a powered USB hub would do so just fine). This is less of an issue with Android tablets with separate power ports, but it remains a problem for smartphones and unfortunately, there's no easy way around it at the moment. All that said, it's possible to connect a portable hard drive directly to your phone via a powered USB hub, even if the phone has to power itself.

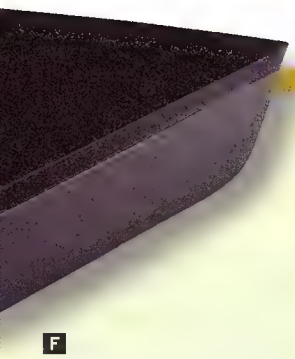
STORAGE #4: SOLID-STATE DRIVES (SSDS)

Solid-state drives (SSDs) are the hot storage item right now and with prices dipping well below $1 per GB, they'll start replacing portable hard drives in larger numbers before long. They're tough as teak and they also consume far less power than a USB hard drive. OCZ's 240GB Agility 3 SSD needs just 5V at 350mA, which is much less than a portable hard drive.

Having several older models on our desks, they're quickly becoming high-speed flash drive replacements. The problem is they still need SATA power and data cables, understandable given that they're made for internal PC use, not connecting to a smartphone.

G Cheap powered USB hubs are great, but need higher-powered AC bricks.

H A 5V/3A power brick is a good idea for powering USB hubs to handle portable hard drives.



F Samsung's Galaxy S III can power a 500GB portable hard drive, but we wouldn't do it for long.

I A SATA 7+15-pin USB adapter connects internal hard drives and SSDs to powered USB hubs.

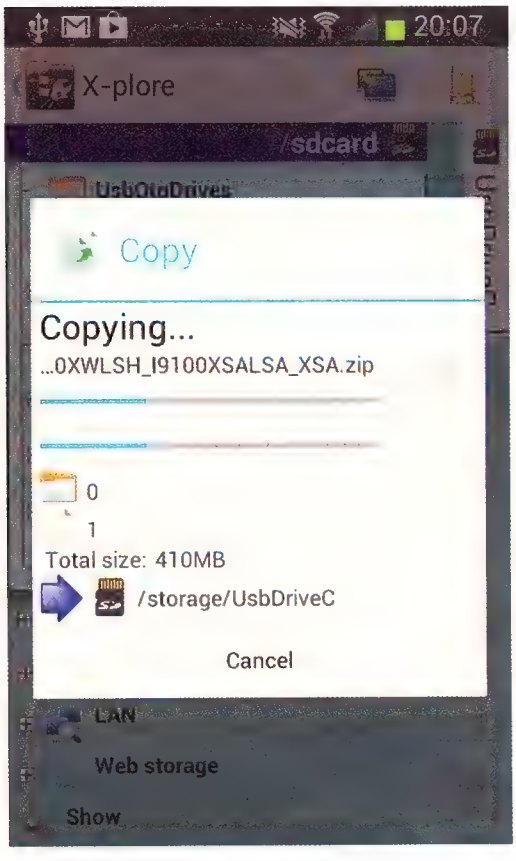
J OCZ's Vertex 2 SSD is pretty old now, but it connects via SATA to USB adapter to a Galaxy S II.

It can be done, though. The trick is to use what's known as a SATA 7+15pin/USB adapter cable. You can get one of these on eBay for under $5, including shipping (**tinyurl.com/o7kgnrb**). It has a Type A USB plug on one end with a special dual SATA plug on the other, specifically designed for SATA SSDs and hard drives. The better ones also have a second Type A plug to source extra power for thirsty drives.

You plug the USB end of the cable into your powered hub and the other end into your SSD, and then connect the hub to your smartphone via the OTG cable. That should trigger either automatic mounting of the drive if it's FAT32-formatted, or allow you to mount it with USB OTG Helper if it runs the NTFS filesystem (see images I J).

DOES ANDROID SUPPORT TRIM?

SSDs don't operate their storage the same way as hard drives. The main difference is that unlike a hard drive, SSDs can't overwrite a storage block that already contains data. They have to erase it and then write the new data. So, unless an SSD reclaims those abandoned storage blocks (a process called garbage collection), it'll run out of storage quickly as fresh, clean blocks disappear. If the SSD tries to reclaim those 'abandoned' blocks during the write process, write speed will fall off a cliff.



K We tested whether our SSD can reclaim abandoned storage blocks. It sure can!

Because SSD flash can only be written to so many times, SSDs have wear-levelling systems to spread the wear and help the drive last longer. However, that means data is being moved around all over the drive and garbage collection can make this worse. TRIM is an OS-driven command that tells the SSD which storage blocks are no longer needed; in effect, it 'trims' the number of blocks the SSD needs to maintain the data in. This has the effect of speeding up write tasks as well as reducing flash cell wear through not writing/maintaining data it doesn't need to.

It raises the question: is Android smart enough to have TRIM support? Android is based on Linux, which had TRIM support since kernel version 2.6.33 through the fstrim utility. Android 4.0 began with Linux kernel 3.0, so all Android 4.0+ devices with eMMC (embedded) storage should support TRIM.

That doesn't mean they all do it well. Google's Nexus 7 reportedly suffers terribly from performance lag due to a bug with its TRIM support. A free app called LagFix has popped up on Google Play (**tinyurl.com/aqqvwf9**) that performs the TRIM command (fstrim) manually and fixes lag problems, but only on devices where TRIM is supported.

THE BRICK BUG

A few months ago, we looked at the Brick Bug that affects Samsung's Galaxy S II and Galaxy Note devices. It's essentially a problem with the internal eMMC storage, where using low-level functions can cause the phone to irreversibly brick itself. *Using LagFix on these devices will brick them.* The author doesn't explain why, but we think it must be because it puts back what Samsung's Android 4.1+ updates take away – namely, the ability to perform low-level formatting.

So how does this affect using SSDs on your Android device? That's a good question that unfortunately raises other questions like: does Android support TRIM over OTG? Do TRIM commands pass through SATA-to-USB adapters? Despite plenty of searching, we can't get definitive answers. However, there's one way to find out.

SSD OVER OTG TRIM TESTING

To test what happens, we fired up a 60GB OCZ Vertex 2 SSD freshly formatted with FAT32, connected it to a powered USB hub and a Galaxy S II phone with 4.1.2 firmware via OTG with USB OTG Helper installed on the phone. We started out by checking the current storage available on the drive to confirm it was clean. Next, we copied a 600MB file seven times to the SSD, deleted those files and went back to check the current free storage space on the drive.

When we checked on the Android 'Settings > Storage' page, Android happily said the full capacity was available, so either TRIM or the SSD's own garbage collection handled the job. Either way, the storage was reclaimed. So as a practical storage option, yes, you can connect an SSD to your smartphone and use it (see image K).

THE OPTIONS ARE YOURS

Connecting portable drives and SSDs to a smartphone might seem like a pretty dopey idea, but we keep saying smartphones are just portable computers. Having features like OTG mean these devices are far more capable than we often realise and it's great to know that OTG provides a world of portable storage options, provided you do it right.

Metro: Last Light

A Soviet shooter with the makings of an underground hit.

PC | @ www.enterthemetro.com | $ $78 PC, $88 consoles

Set in the radiation-shielded Moscow subway system following a devastating global war, *Last Light*'s story picks up where *Metro 2033*'s ended. You once again play Artyom, now a newly minted member of the Order – a sort of subterranean Night's Watch, formed from ex-Spetsnaz soldiers. Two important things have happened: with Artyom's help, the Order has located and taken control of D6, an experimental weapons facility likely to become the envy of the Metro's other warring factions. Secondly, Artyom has just used the missiles within D6 to commit genocide, obliterating a race of benign mutants who had the poor luck of being 12-foot tall wormy-mouthed psychic ape monsters whose mere presence causes men to die in terror and pain. Because of the stigma attached to being a telepathic death beast, not everyone is convinced of their benevolence and when one is found to have survived the holocaust, Artyom is dispatched to kill it.

What then follows is a round trip through the desolate tunnels of the Moscow subway system, along underground rivers, into military bunkers and inside other even darker places. The echoing warren of tunnels creates a powerful and oppressive feeling of enclosure and decay: lights sputter and surge, concrete walls crumble or run with water. Groans, mutters, creaks, clanks and drips ripple up and down the long black tunnels. The austere militarism of a nuclear bunker segues into the grimly functional tube network and the art deco opulence of the stations – all now rotting or reclaimed by nature. Death is everywhere – we can only imagine that the developer, 4A Games, has an entire department dedicated to corpses.

Last Light has more incidental details and side rooms to explore than most shooters. A mixture of game balance and scripting works to trivialise your input. Some of the early stealth sections are so easy that we felt irked that we were missing out on potentially entertaining combat. The game barely seems to resist your forward momentum: even open confrontation poses little threat on normal difficulty and you'll rarely find yourself running low on supplies. On the harder difficulty, combat becomes appropriately lethal and resource management more important, but the trade-off is that the game's duff bullet-sponge boss battles become a right old slog.

When the stealth and combat systems are allowed to blossom, *Metro: Last Light* is riveting. Humans are still the most fun to fight and the most exhilarating encounters are the ones that give you a chance to whittle down the opposition using stealth before forcing open combat in large, multi-pathed arenas. The dark is a powerful ally and many of the battles begin with a gentle puzzle element as you work out how to reach circuit breakers and deactivate the lights. But what's the point of carting all that ammo around if you don't get to shoot it into people? It would be a waste given your arsenal's enjoyable variety and uniform heft. Even when silenced, the pistol feels potent and mean, spitting beads of death with a contemptuous 'phut'. Each weapon is upgradable and customisable, letting you choose between a number of sights and scopes, and giving your three weapon slots an enticing tactical flexibility.

The checkpointing system and the low default difficulty are the only two bugbears imported from console land. Graphics options are plentiful, letting you tweak Vsync, motion blur and tessellation, but not FOV, presumably to maintain the necessary sense of claustrophobia. When it's all working perfectly, *Metro: Last Light* assembles a forlorn and beautiful world, and your journey through it takes in many poignant and terrible sights. When you get some autonomy it creates brilliantly panicky, desperate gun battles and heart-in-mouth stealth escapades, but it's worth it for the ride.

Marsh Davies

✔ A brilliantly realised world wrapped around a story-driven shooter...
✖ ...that occasionally forgets you want to play it.

8/10

FEZ

Well worth the excruciatingly long wait and associated hype.

PC

@ fezgame.com

$ US$9.99 download from Steam

Anyone who's seen *Indie Game: The Movie* knows that Phil Fish, the main guy behind *FEZ*, threatened to commit suicide if his game wasn't shown at PAX in 2011. That's because *FEZ* struggled immensely in its nearly six-year development phase – part of that was attributed to partnership woes, another part came down to Fish's inherent struggle for perfection. A perfection that we think was pretty much attained.

In *FEZ* you play as Gomez, an adorable 2D creature who stumbles across a strange artefact called a Hexahedron, which explodes his world into 3D (he gets a cute hat, too). A 'hypercube' explains that you must find all of the fragments of the Hexahedron (32 gold cubes) before the world grows unstable and is ripped apart. Small details like the landscape shifting from day to night, tiny pixelated butterflies and flowers, quirky dialogue ("You are looking nice and flat today"), and Gomez's yawning and juggling of his hat make this game a wondrous delight. The absolute winner, though, is the extremely intricate level design, where players need to rotate the view (and the gameworld) 90° to the left and right. You'll need to utilise all four sides of a three-dimensional structure to walk, jump, climb and traverse the mind-twisting landscapes.

Its cute factor belies its difficulty and *FEZ* can be downright frustrating, especially when it comes to gathering all the pick-ups. For every cube there's a blue 'anti-cube' and these are infinitely more difficult to attain. Rather than just moving over it to pick it up like you do with regular cubes, anti-cubes require you to look closely for any *Tetris* pieces and use the numerical system. This involves inputting controls to represent codes; for example, one code is: Up, Left, D, spacebar (jump), A, Right, spacebar, Down. While that can be very complicated stuff, *FEZ* is a truly beautiful game that you're sure to get lost in (both literally and metaphorically).

Goldie Hong

✔ Visually stunning, innovative level design, no penalty for dying, challenging.

✖ You'll need the aid of a walkthrough to uncover all of the anti-cube codes.

9.5/10

Injustice: Gods Among Us

Superman's gone all rogue.

PC

@ injustice.com

$ $69

'What if our greatest heroes became our greatest threat?' It's a fitting tagline for NetherRealm Studios' latest 2D fighting game, *Injustice: Gods Among Us*, which pits Superman's Regime against Batman's Insurgency in an epic DC Universe showdown. See, Joker's tricked the usually mild-mannered Kryptonian into killing Lois Lane and their unborn son, which has landed him a face full of Superman's fist and divided the superheroes.

In single-player mode you assume the role of a different DC character each chapter, with iconic heavyweights Green Lantern, Wonder Woman and Green Arrow (to name a few) taking on a series of one-on-one fights with the particular characters' foe. So in chapter one Batman faces Deathstroke, Bane and Lex Luthor. Aside from the typical Versus platform, S.T.A.R. Labs is an extra mode with 240 character-specific missions that seriously up the value and challenge factor.

Injustice borrows mechanics from other big fighter franchises; for example, the ability to smack your opponent silly into a whole new level in the arena is something we've seen before in *Tekken 6*, and the awesome supers unique to each character has most recently been seen in *Ultimate Marvel vs. Capcom 3*. But NetherRealm has commendably upped the ante, with more intense super moves combining slo-mo with grand, fast-paced action sequences. Our favourite would have to be Aquaman's, which sees your opponent get eaten by a shark underwater. Ouch.

Control-wise, this isn't a complete walk in the park. Sure, anyone can button mash their way through, but higher-end combos involving some controller juggling can be tough to pull off properly. While some will feel that the storyline (which involves alternate realities and doppelgängers) is massively OTT, we'd argue that it's been done in such a well thought-out and careful approach that it's really an ode to true DC fans, who will pick up on small details that reference their favourite comics.

Goldie Hong

✔ Intricate plot, fun super moves, interactive background, amazing visuals.

✖ 'Timed wagering meter' is confusing and unnecessary.

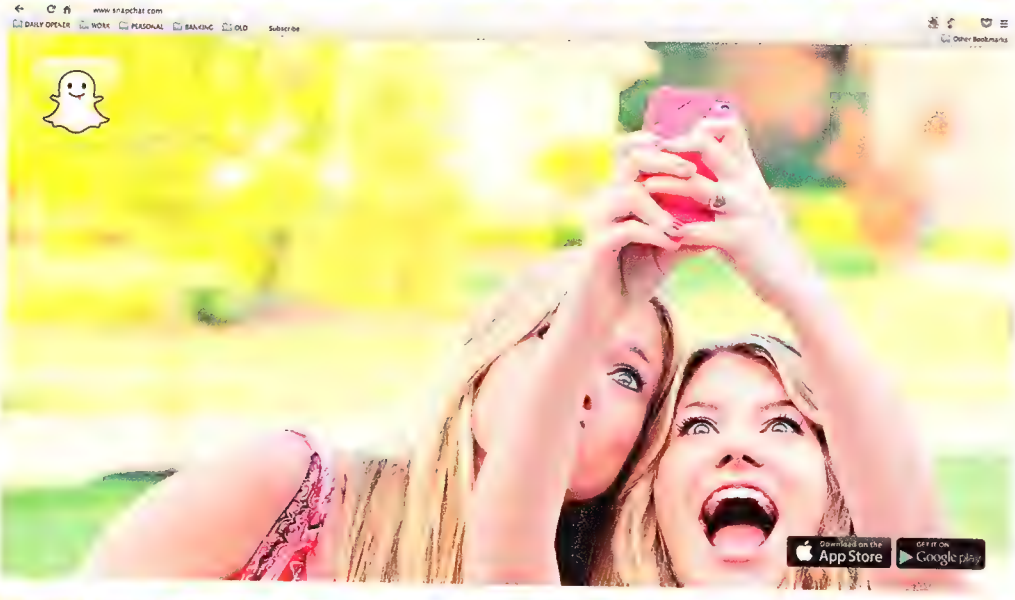
9/10

PETER DOCKRILL

TWITTER VERIFICATION IS THE NEW BLACK

Forget how many Facebook friends you have and never mind your Klout score. The new way to know you've arrived is when Twitter gets in touch personally to verify your account, giving you that nice little blue tick badge beside your Twitter profile to indicate that you're really you. The real, authenticated deal and important enough to be recognised. But how exactly does Twitter decide who's important enough to be singled out for verification?

According to Twitter's web site: 'Twitter proactively verifies accounts on an ongoing basis to make it easier for users to find who they're looking for. We concentrate on highly sought users in music, acting, fashion, government, politics, religion, journalism, media, advertising, business and other key interest areas'. But what if you're just Joe Smith; can't you get verified to let people know you're *the real* @joesmith? Nope, sorry folks. Twitter's policy: 'We do not accept requests for verification from the general public. If you fall under one of the above categories and your Twitter account meets our qualifications for verification, we may reach out to you in the future'. Guess I'll keep waiting then. I'm sure they won't be long now.

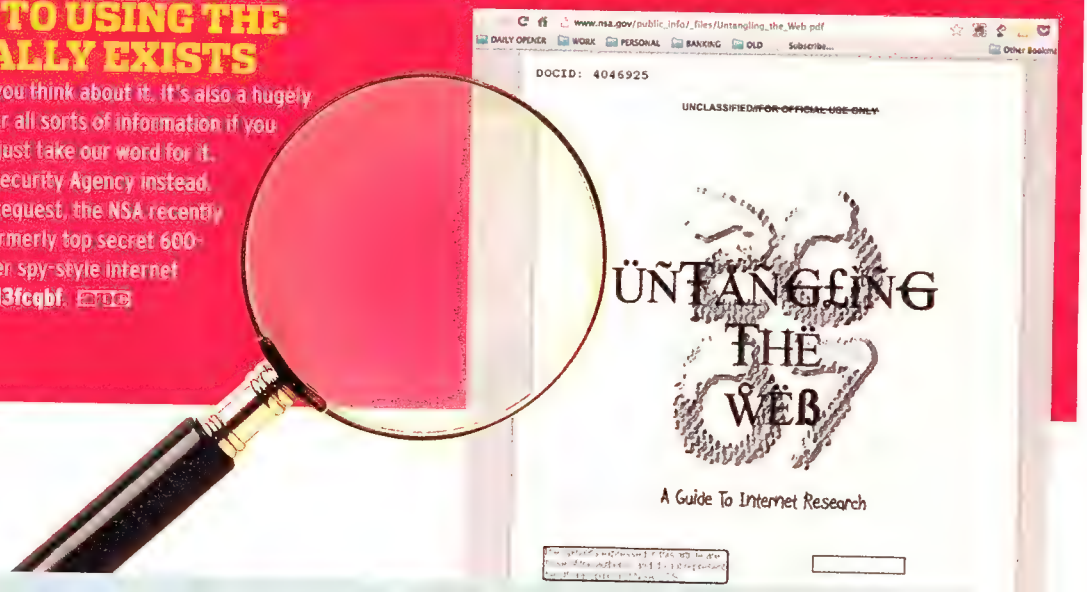


SNAPCHAT IN A FLAP

Ah... Snapchat. Beloved of teens and probably unheard of by anyone older than 21, it's a ridiculously successful image sharing app for iOS and Android with a twist: after your friend receives the picture, it self-destructs, so that they can't save it or send it on. Hence great for naughty or silly pics you want to send in semi-secret. Or as Snapchat puts it: 'The allure of fleeting messages reminds us about the beauty of friendship...' Or at least, that was the idea. It turns out Snapchat's images aren't so fleeting after all, with a US digital forensics firm discovering that the app actually saves the images and hides them in a secret folder on your phone, from which they can be retrieved if you have the right knowhow (although the process takes hours, even for experts). Is there a moral in this? Yep. Think before you snap.

THE 'SPY'S GUIDE TO USING THE INTERNET' ACTUALLY EXISTS

The internet's pretty complicated when you think about it. It's also a hugely powerful tool, with which you can uncover all sorts of information if you know where (and how) to look. But don't just take our word for it. Take it from the United States' National Security Agency instead. In response to a freedom of information request, the NSA recently made public 'Untangling the Web' — its formerly top secret 600-page guide for how NSA agents can master spy-style internet research. Give it a squiz at **tinyurl.com/d3fcqbf**.



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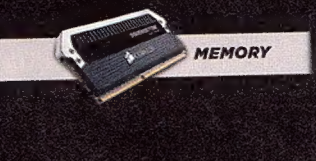

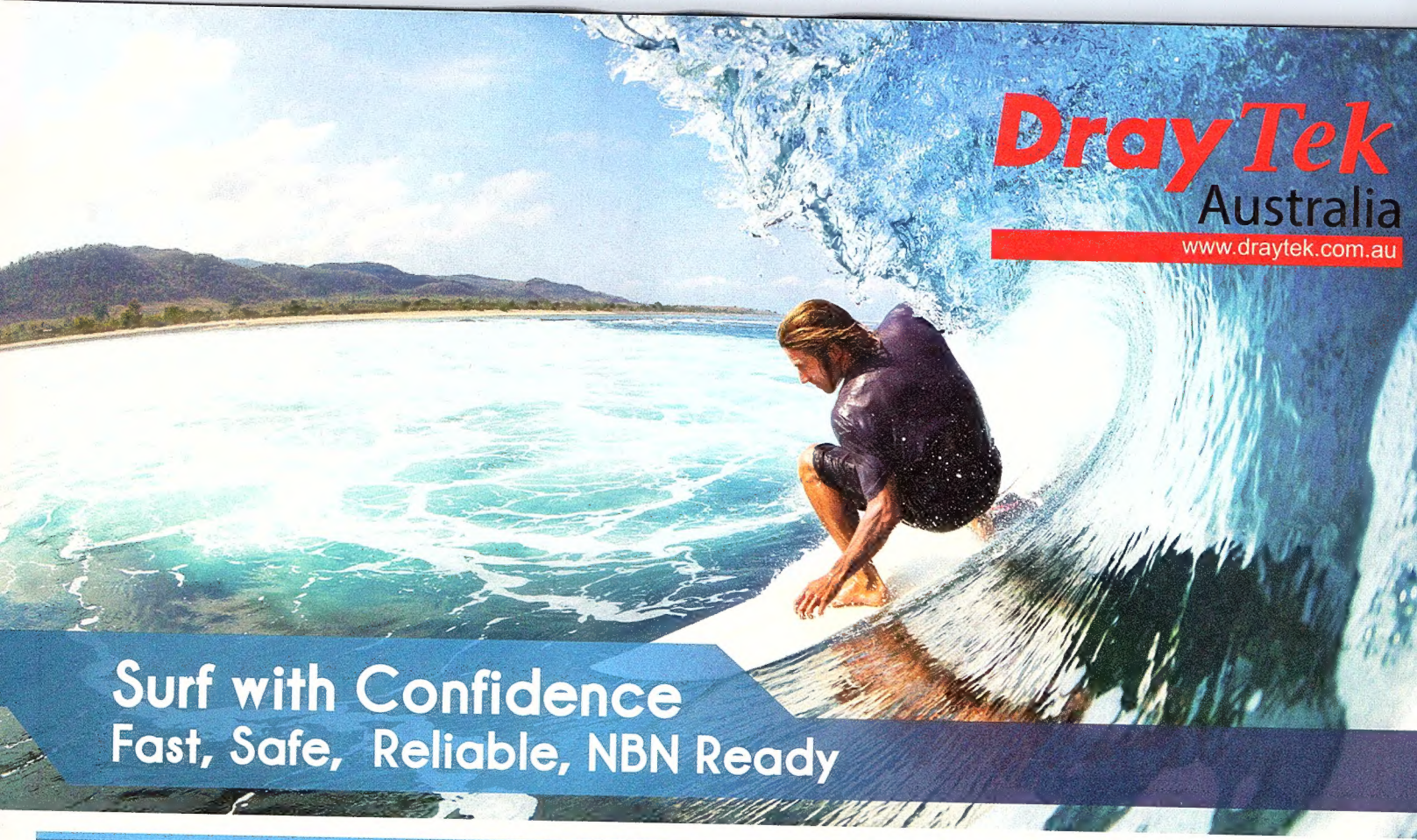

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